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Vizagapatam Harbour

By

Mr. W. C. Ash.

Under the auspices of the Vizagapatam Branch of the Madras Geographical Association, Mr. W. C. Ash, Engineer-in-Chief of the Vizagapatam Harbour Construction, delivered on the 15th December 1932 a lecture in the hall of the new Medical College, the subject being the Vizagapatam Harbour.

The lecturer first drew, by means of diagrams, a parallel between the conditions prevailing at Vizagapatam and those at Madras. He explained that the "littoral drift", which has had to be so seriously taken into account at Madras, evidences itself also at Vizagapatam, despite early reassurances to the effect that this volume of sea-sand would be interrupted in its northerly travel by the deltas of the Godavery and Kistna and would merge itself into them. Although this may actually happen, it does not, in the outcome, dispose of the difficulty in connection with Vizagapatam, since it would appear that the deltas lose on the northern side, as a result of oblique wave action, as much as they gain on the South and the littoral drift is to all intents and purposes continuous. A million tons of sand per annum pass any point on the shore at Madras and a similar quantity is found to be in motion at Vizagapatam.

The differences in configuration of Madras and Vizagapatam had not been greatly taken into account when the early scheme for a harbour at Vizagapatam were under consideration, and the diagrams showed a strong resemblance between the project car-

ried into execution at Madras and those which had been proposed for Vizagapatam.

CHANGE OF PLAN

Ideas had later veered in favour of an inner harbour, such as was now being provided, and it was now clear that, had the former plans been acted upon, very serious trouble, in the way of maintaining the entrance to the outer harbour, would inevitably have been encountered.

The scheme which is now in hand for securing protection for the harbour entrance was explained by diagrams, and the possibilities in the way of expansion of the inner harbour, once the difficulty in connection with the channel was surmounted, were demonstrated. The land acquired by Government for the construction of Vizagapatam Harbour and its later extension comprised the greater portion of a vast lagoon, in process of siltation. Advantage had been taken of the scope offered by this magnificent site for laying out a harbour capable of expansion to any considerable size. The railway, road and marine facilities which this development might call for had been carefully studied and provided for and the methods of reclaiming the great areas of swamp whilst dredging the waterways had been schemed out.

A parallel was next drawn with the Port of Durban, and it was explained how the very close similarity in the configuration and physical conditions of the two harbours had led the lecturer to visit South Africa for the purpose of making a special study of conditions there. It was shown that this similarity was accidental, in so far as it rested on certain physical facts, but that the natural processes resulting from these had inevitably been alike in both cases, and had thus combined to make the similarity more striking. The earlier physical features consisted of an area of high ground, roughly forming a crescent in each case, the enclosed area at one time having been open to the sea. A stream, of small volume in the dry weather, drained in each instance through the lagoon. Tidal conditions were very similar and the dominant winds corresponded in a large measure. The result was, at both places, that the channel formed under the lee of the "bluff"; that it was impeded by a sand bar, which for a harbour to be maintained necessitated persistent dredging; and that a sand spit formed between the sea and the inner lagoon. The towns of Durban and Vizaga-

patam had each been partly sited, as a matter of course, on these corresponding sand spits. The comparison was made by means of lantern slides, showing the close likeness not only between the respective configurations but also between the external aspects of the various features.

Durban's Success. A number of slides were shown to illustrate the great developments which had taken place in both the town and harbour of Durban, mainly as a result of the solution of the difficulties encountered in making the harbour accessible for ships of all draughts and sizes. This struggle, on which Vizagapatam was entering, had taken many years at Durban, as was shown by means of graphs; and the curves showed also the great prosperity which had rewarded the final success. There was no mistaking the fact that the increase in figures of trade, in population and in wealth were, in the case of Durban very largely to be attributed to the overcoming of the difficulties in connection with the harbour, and it was hoped that there would be a similar trend at Vizagapatam. The views of the town and harbour were commended to the audience as a pointer to what might happen, given favourable conditions, in the case of Vizagapatam, of which Port Durban might be regarded as a "big brother" with a strong family resemblance.

The lecturer endeavoured finally to convey, by means of a slide of a working model, an idea of the entrance to Vizagapatam Harbour when the two ships, now being prepared for sinking, have been placed in position to form the core of the new breakwater. This novel scheme for creating a breakwater had been decided on in view of the urgency of the problem of obtaining a measure of protection at the Outer Channel and also of the fact that merchant ships were, during the present trade depression a drag on the market and could be bought for inconsiderable sums. The object of the barrier thus to be created was to cause the sand to deposit in an area clear of the channel and to afford protection under which dredging could be carried out.

Mr. B. V. Narayanarao, one of the Assistant Engineers of the harbour, brought the lecture to a close by a display of cinematograph views of the construction work and of the recent entry of the s.s. "Janus" into the harbour.

Sir J. C. Coyajee, who presided, said that the lecturer (Mr. Ash) had envisaged a century of prophecy, indicating Vizagapatam's rise in the future.

Geographic Controls

By

Mr. Tekumalla Rama Rao.

It is generally recognised at the present day that individuals and groups of individuals are influenced by their environment, and that they react to such influence by modifying the environment itself, of course within certain well-defined limits, to suit their needs. Such direct relationship is not as obvious in the life of the urban populations as in the case of those of the rural areas, who are more truly the children of the soil and products of the environment. The city life is determined in a large measure by influences which go beyond the limits of the immediate environment by means of industrial, commercial or cultural contacts with distant and sometimes different environmental influences, while the economy of village life is based largely upon agriculture and allied occupations, which depend upon the direct exploitation of the geographic opportunities afforded by the home region. The nature of the soil and the relief of the land have their share in the shaping of the life that is evolved in their midst. Even in the case of the urban and industrial population a careful investigation will show that in the final analysis, the town will depend on some local advantage of site or situation, which will account for its development.

A cursory examination of the physical environment gives us three or four important factors, whose operation may be looked for in the geographic study of any human group; as for instance, relief, geology, climate and vegetation.

Relief.—The study of relief gives us an idea of the general lie of the land, the distribution of the mountains, valleys and plains, oceans, rivers and lakes, in fact of all the physical features, which exert some formative influence on the life of the region.

Consider first the great physical fact of the primary distribution of land and water on our globe. Over 70% of the earth's surface is covered by water leaving only a little more than one quarter of the globe dry. This vast sheet of water is one great nega-

tive region from the point of view of human settlement. If we consider, in addition, how nearly a quarter of even the dry land is over 3,000 feet in altitude and for the most part inaccessible, while there are vast deserts at much lower heights we see at once how strictly limited are the resources of the world. The world's present population is about two thousand millions; and according to Ravenstein's calculations the earth will attain the maximum population of some six thousand millions in two centuries, even with the proper treatment of the land and at the present rate of increase. Thus we have here a great and fundamental geographic control, expressed in general terms, whose incidence nevertheless is bound to be increasingly felt in the future.

Turning to the oceans and seas, we see that they had acted for a long time as barriers in the way of human intercourse, while they still continue to be effective geographical boundaries. At the same time, their value to human life may be appreciated when we consider how they function as the inexhaustible reservoirs from which we draw our water supply in the form of rain. Regions that do not come under the oceanic influence for their rain develop into deserts, such as the Sahara, which are so little conducive to life of any kind.

The mountain ranges of the world are another great physical feature. They are even today but sparsely populated barring a few hill stations and tourist centres; thus they are by themselves a negative region. They have also acted through the long historic times as barriers to human movement, in many cases confining peoples into isolated groups, the effects of which isolation persist even to-day as differences in national individuality, linguistic dialects, cultural development, social tradition, and sometimes religious belief, all of which differences make all too complex the already complex problems of the world.

The mountain ranges of the world have influenced human life in an indirect way also, by influencing the climate. For, they are as much of a barrier to the spread of climatic influences as to the spread of population. In Asia, for instance, the great system of mountain ranges stretching from Asia Minor far into North-Eastern Asia may be considered to be a great climatic wall between the great land mass to the north of them and the group of peninsulas to the south. It is well known that the Himalayas protect India from the inflow of cold winds in winter from the high-

pressure region of Central Asia, while they cut off the interior of Asia from the monsoonic influence in summer. The Alps in Europe similarly protect the Mediterranean Region from the cold Central European winds in winter and help to give that region their characteristic mild winters. The Rockies in North America afford even a more unique example of climatic barrier owing to their north-south trend. They shut off the interior of the continent from the oceanic influence conveyed by the westerly winds blowing from the Pacific, and restrict the development of the Mediterranean climate to a narrow strip on the Californian coast and the warm temperate oceanic climate to British Columbia. Thus the vast interior of the continent suffers from extremes of climate even at low latitudes.

Before we leave the great mountain regions we may also note that mountain life in general tends to make the people hardy, independent and self-reliant. At the same time, life conditions are rendered so difficult that this type of region has not been able to develop any high type of civilisation.

We may now pass to the plains, which afford a significant contrast to what has been said about the mountains. The great civilisation of the past, of China, India, Babylonia and Egypt were all river plain civilisations; and it is not mere accident that determined their localisation. For, it is obvious that for the development of the higher side of man facilities for the permanent settlement of fairly large groups of men and a certain amount of leisure afforded by easy and abundant production of food products are among the first conditions to be fulfilled; and such favourable factors obtain easily in the fertile river plains, where agriculture can be most profitably practised.

The plains, even today, hold their own, being still some of the most densely populated regions of the world. Though mineral wealth and industrial development are accounting for dense concentration of population elsewhere, the plains, whether in the Americas, Australasia or Russia or in their more limited distribution in other parts of the world, are still important as the great and sole sources of our food products and some very important raw materials, and they are bound to remain so in future, so far as one can see.

Geology.—There are two outstanding ways in which the subject of Geology makes its incidence on Geography felt, by the study of soils and by the study of mineral wealth, both of which throw considerable light upon the distribution of man and his occupations.

The influence of soil is most obvious in the great alluvial tracts such as those already mentioned. The point may be further illustrated by reference to cases of specially rich soils; the Black Cotton soil of the Deccan Plateau, the Black Earth of Russia and the rich volcanic soils of Java to utilise which rice cultivation is carried thousands of feet up the side of extinct volcanoes.

As for the minerals, their distribution, particularly of coal and iron, has assumed very great importance since the Industrial Revolution. We may consider England as typical of the industrial age. Her population has increased at such rapid rate that she is not agriculturally competent today to support her very population for two days in the week if left on her own resources.

Germany, which was predominantly agricultural until quite recently, is of late importing much food. Even a young country like the United States of America is apparently passing fast from agricultural to the industrial age.

From the point of view of the distribution of population the outstanding feature of the new age is the great drift of population from the rural to the urban areas, which are the seats of industry and commerce. Consequent on such a drift there has been impressive growth of cities. Side by side with the manufacturing towns or groups of towns, we have sea-ports like Marseilles or Hamburg, and the great regional centres of politics and high finance like London and Paris. An extreme case of very high concentration is furnished by Great Britain which is terribly urbanised, having nearly 40% of her population packed in seven monstrous conurbations. A similar development of industry with similar concentration of population may be seen in Germany in the Middle Rhine Valley and the Ruhr Basin.

Among other factors of localisation coal has been, so far, the most effective, for the location of modern industry is regulated by the position of motive power, which is by far furnished by the coalfields at the present time.

Climate.—Climate is another important physical control, whose importance may be appreciated when we consider how it furnishes the basis for the delimitation of the worlds' Natural Regions. Temperature and rainfall are, of course, the most important elements of climate, over both of which man has no control. These two factors in conjunction with soil are primarily responsible for the varied vegetation of the world. The hot and moist equatorial forests, the Mediterranean Lands with their characteristic mild and moist winters and hot and dry summers, the monsoon Lands, where rains occur in the hottest part of the year, the temperate grass lands, which are the granaries of the world, as well as the hot and cold deserts of the world, all are first and last effects of climate with corresponding influence on human reaction.

I have indicated very briefly some of the important geographic controls, which direct and regulate human life. In the study of such controls we have to bear in mind two important points. Firstly, these influences never act in isolation, one or more or all may act in a region; secondly, the incidence of the different factors may vary from place to place and from time to time.

In all that has been said emphasis has been laid upon the physical environment of man. But to complete the picture and put things in their right perspective, we should remind ourselves of the great principle that human development is the product of interaction of two forces, the force of circumstances, which will include all the factors of physical environment, and the force of human intelligence, which will include within its scope the collective experience of the ages, which is the common heritage and the richest asset of any human group. These two forces constantly interact in the evolution of the life of our race; and the degree to which the latter has succeeded in utilising the possibilities of the former and in overcoming the limitations set by it furnishes a measure of the civilisation attained at any particular time by a people. A dispassionate study of the worlds' peoples along these lines helps to understand and appreciate the cultural differences, national peculiarities and economic inequalities, which, without such understanding, are bound to breed prejudices of a dangerous character. But where there is such understanding there develops an atmosphere of tolerance and co-operation; and herein lies Geography's great contribution to the solution of the world's problem today. Hence in all geographical studies adequate emphasis must be laid upon the correct estimate of the nature and scope of the geographic controls,

My Tramps in the Himalayas

By

Gertrude E. Benham.

There are many beautiful valleys in the Himalayas close to the Tibetan border, and as they are beyond the force of the monsoon, they are delightful places in which to spend the summer months. There may be occasional showers or storms and some cloudy days, but unless one wants clear weather to sketch the high peaks, clouds often add to the beauty of the mountains, and the showers freshen the grass and vegetation. When the sun shines, the days are warm, but the nights are often cold. The chief drawback is the wind, which in some valleys blows hard every day from about 11 a.m. till the evening. True, the journey is long and somewhat difficult, and unless one is willing to live on the produce of the country, one cannot procure other food. Some of the larger villages have a shop or a baniya, but often the shop is closed or the Baniya away. The villages are inhabited only during the summer, as, in the winter, they are buried in snow and the people go down to lower and warmer levels; so one month—May, June—of each year is spent in going up, and one month—Oct. Novr.—coming down. At these times the road is crowded with men, women and children, all carrying some of their household goods and hundreds of sheep, goats, donkeys, ponies, oxen, mules, etc., all laden with tents, food and other things. The summer is chiefly spent in agriculture and trading with Tibet and Nepal. The food they grow is chiefly papa and palti both of which make excellent roti, and jong and ooa—a kind of barley—the grain of which is roasted before it is ground and made into suttoo. I have lived on these foods for many months on my various journeys in the Himalayas and found them very good. There are, practically, no trees in the higher valleys. Pines grow up to about 11,000 feet and birch about 500 feet higher, though I saw quite large birch trees growing at Kuti, 12,400 feet, and also higher, on the way to Jolinka. Fuel is a difficulty but if the people planted young trees, when they cut others down, they could have a better supply. The flowers in many of the valleys are very beautiful and it is interesting to notice how the flora varies in different valleys and also how it changes. When I first went up to Kalchu, to sketch Nanda Devi,

the ground was carpeted with pink oaxifrage and the rhododendron bushes still had a few pink blooms. I stayed for a week or so, but clouds would not let me have a clear view of the peaks and as I had arranged a trip to Lapthal and Chhaldu, over the Untadhura Khingru, Balch and Kyo Passes (all about 18,000 feet) I had to leave without a sketch. On my return to Mileno about three and a half weeks later, I thought I would make another attempt. So, I went up to Kalchu again. All traces of pink had disappeared and the ground was blue with gentians, and I succeeded in making the sketch I wanted. There are several varieties of gentian and edelweiss in the Himalayas, but I have not found the deep blue trumpet gentian and one misses many of the tiny Alpine flowers which one finds near the snow and ice in Switzerland and the Alpine rose in the Himalayas is pale yellow and not pink as in the Alps. The blue poppy (in some districts there is also a pale yellow variety) is one of the beauties of the Himalayas, but is seldom found below 12,000 feet.

My first journey to Milem was in 1924. I walked from Mussoorie by way of Josinath, the Kuari Pass and the Pindar Glacier, and by the time I reached Mansiari it was the middle of the rainy season. The road was very bad and sometimes I was not sure if it was a road or a water course. Several of the bridges were broken, so we had to make a long detour across a peak of over 15,000 feet to rejoin the road. The leeches were very troublesome and we were attacked by hornets, but fortunately they did not pursue us far. The coolies threw themselves on the ground and covered themselves with their blankets. We had to spend the night on a narrow shelf of rock on the face of a high cliff, where there was no room to put my small tent, so I put my bed on the shelf and the water from the rocks overhead dripped on me. As we got further up, nearer Milem, we got away from the rain and found everything much drier. The Milem glacier comes down to about a mile from the village, but for some distance it is so thickly covered with moraine that the ice can scarcely be seen, as is the case with so many of the Himalayan glaciers. There is a small lake—Sandilkund—close to the edge of the glacier, about 5 miles up, which is considered sacred, and pilgrims bathe in it, on their way to Kailas. I wanted to go to Malari by way of the Untadhura and Shalshal Passes, and accordingly made arrangements for jibus to carry my things. When we reached Topidunga, the far side of the Untadhura Pass, there was a heavy snowstorm, so we waited there a day. There were many shepherds camping

there, with their sheep, and the sheep would persist in crowding round my tent for shelter and warmth. They kept pressing against each other to get near the tent and knocked over my boxes and basin, etc., and I feared the tent would fall. I kept driving them away, but it was almost useless and the shepherds took no notice. Then the men with the jibus said the Shalshal Pass was too long, as they feared more snow, so they decided to go by the Gerthi Pass which was much shorter, but was really only a disused goat-track, and impassable for laden animals, after the first two stages. When we arrived at the place where the animals could go no further, the two men went on alone quickly to Malari to fetch coolies to carry my things, leaving me alone in my tent, with my cook and the jibus and they said they would return in 4 or 5 days. We were absolutely alone, as there was no human habitation nearer than Malari and my cook threatened to leave me unless I paid him Rs. 15 then and there. Of course I refused and said I would not pay him a pice till we got to Malari, so he packed up his things and walked off. I knew he would not go far, so I kept on with my needlework, and after 3 or 4 hours, when I was thinking of getting lunch ready, he slunk back and I had no more trouble with him up there. The men returned with the coolies, so I went on to Malari while the jibus and the men returned to Milem. I pitched the tent about half a mile from the village, where there was a level space, and stayed a week or two. It was the end of September and I thought the monsoon was finished and I was planning to start down, when, on getting up one morning, to my dismay, I found everything white with snow, which was nearly a foot deep and still falling, and my tent nearly collapsed through the weight. I sent my cook to the village to ask if I might have a room as one cannot live in a snow-bound tent, and it was impossible to cook anything. At first, the Lumbardar was very churlish, but afterwards said I could have a room, so I moved all my belongings to the village. The room was a sort of loft over a stable where sheep and goats were kept, most of one side was open, and there was a large opening in the roof to let out the smoke, which also let in the snow, and all the roof leaked more or less. So it was difficult to find a dry place to put my bed. It was most difficult to get food and fuel and the Lumbardar was most disobliging—a very unsual thing in the mountains—and if it had not been for the kindness of the villagers who brought me food, I should have had a bad time. The snowstorm lasted for nearly three days, and then I had to wait two or three days for the road to clear a little, before starting down. As we got lower,

we found the three days' heavy rain had done great damage. In some places the mountain side had slipped and the path completely carried away for some distance and we had to dig our hands and feet in the ground and progress as best we could, and to add to the difficulty, there were large boulders on the slopes above, which looked as if they might fall at any moment. When I got down to Tapoban, where I had stayed on my way up in the spring, it was hard to recognise the place. The effects of that rain were felt far away, and, at Cawnpore, the Ganges rose to such a height that fears were entertained for the safety of the bridge. There was no rains in the plains and people wondered to see the river rising higher and higher, without any apparent cause.

There is another beautiful valley, east of the Milem valley and running parallel with it separated by a range of snow mountains in which is the beautiful groups of peaks named Panchchula. This is the Darma valley and the chief village is Nagling. There are other villages higher up and the valley divides the highest village Shibu being in the western branch. East of the Darma and also parallel with it is the Kuti valley which I have already mentioned. It is interesting to notice the differences in houses, dress, ornaments, flora, agriculture, etc., etc., in these different valleys, although they are so near to each other. There may be also differences of speech but as I do not know any Pahari or Bhotian I could not tell. In Milem, the houses are mostly low, built of mud or stone with very small openings for doors and windows, if any. The women wear very little jewellery and dress chiefly in dark plain colours. Some of the houses in Nagling have an upper story and painted woodwork, and the women wear brighter colours, of the several strips of different coloured cotton stuff, stitched round the bottom of their skirts and much jewellery in the shape of necklaces, rings, brooches, etc. I bought one ring made of a round piece of amber about 2 inches in diameter, set in silver with a small turquoise in the centre and a silver band for the finger. When wearing it, it nearly covers the two adjoining fingers. They also wear long chains with rupees attached 2 or 3 inches apart and as some of these chains come down almost to the knees, they must be very heavy. In 2 or 3 of the Darma villages the women wore very curious earrings, the shape of a note of interrogation '?'. They were made of silver and about 6 or 7 inches long. I did not see them anywhere else. Kuti is a very picturesque village. Well-built houses of stone and many with an upper story and carved woodwork round the doors and windows. Many of the women

work embroidery on their dresses and all wear beads or silver necklaces and rings. As it is so near to Tibet there are many Tibetan things in use, cups, boots, hats, aprons etc, many of the people speak Tibetan as there is constant intercourse with Taklakot which is a large trading centre a few miles over the border.

Sugar Industry in India

BY

MR. K. C. RAMAKRISHNAN, M.A.,

SUGAR POSITION IN INDIA

Sugar in various forms has been an important article of diet in India from ancient times while it was for long a rare medicament or costly luxury to the people of cooler climates. But the per capita consumption of sugar in industrial countries has in recent times increased tremendously, while in India, we believe particularly in South India, it is yet at a low level.[1] Our country is reputed to be not only the original home of sugarcane; but she has even now the largest area under cane in the world. She was until quite recently the largest sugar producer, but Cuba now has taken the lead and Java threatens to overtake us though with a fifth of our acreage. India is unique among the chief sugar producing countries of the world in that she has no exportable surplus and in fact imports a very large quantity, now nearly a million tons of white sugar, to supplement the home production of 300,000 tons of white sugar and 3 million tons of *gur* or brown sugar. This is partly due to the fact that we have a very much larger population to feed unlike most other cane growing countries; while our yield is much lower than in many other tropical lands. The most important problem is to make India self-sufficient in respect of sugar, which next to cotton goods is the largest single item of imports into this country costing us Rs. 15, crores annually. Protection to the industry has been recently assured by the levy of substantial duties on imports of foreign sugar which will not be reduced for 15 years, within which time the industry is expected to expand to meet the needs of the home market and dispense with the need for heavy protective duties. How far South India, the Madras Presidency in particular, can help in the solution of this problem is the subject proposed to be discussed in this paper. We, as students of Geography, may stress the 'natural advantages' that this part of the country possesses for sugar production, which is the first condition laid down by the

1. Report of the Imperial Sugarcane Research Conference, 1931, p. 17.

Indian Fiscal Commission for grant of protection. But we shall be deceiving ourselves if we ignore the economic handicaps to such development.

SUGARCANE, AN ESSENTIALLY TROPICAL PLANT

Sugarcane is essentially a plant of the tropics and thrives best in warm climates where the temperature is uniformly high, with an average of 75° F., the sunlight is strong and showers are frequent during the growing season with an average of 50 inches, unless supplemented by irrigation. It is susceptible to cold and frost on the one hand and drought on the other, either of which leads to smaller size, short joints, higher fibre content, reduced tonnage and lower sugar yield per acre. There are no doubt canes found on the edges of temperate zones and in subtropical regions such as Argentine, Louisiana and Natal but they are selected so as to mature in 7 or 8 months, and not allowed to grow till 12 months or more as the tropical canes are, lest they should suffer from frosts. Indeed, cropping power in all such cases is sacrificed to early maturity and the conditions of cropping are by no means ideal.[2]

ANOMALY OF SUGARCANE IN NORTH INDIA

The most striking feature of the distribution of sugarcane crop in India is the concentration of 75 per cent. of the area in the subtropical regions of the United Provinces, the Punjab and Bihar, all lying north of the Tropic of Cancer. Among themselves they account for a little more than 2 million acres while in the rest of India lie scattered the other ¾ million acres of sugarcane. The Indo-gangetic valley has no doubt advantages in the high humidity during monsoon months, in the general lie of the country with its vast level land, the distribution of the big rivers and its tributaries and the new irrigation channels, the fertile loamy soil and the presence of subsoil moisture, all conducive to the growth of cane. But North India is subject to extremes of temperature; very low humidity and scorching heat before the monsoon compel close planting of thin canes resulting in low yields in unirrigated tracts, while growth is checked after November when severe cold sets in and lasts till February.[3] Frosts are feared not only in North India

2. Finch and Baker: Geography of World's Agriculture, p. 71.
3. Howard: Crop Production in India.

but even in Western India, in the tract under the Godavari and Pravara Canals where they have occasionally damaged the canes and adversely affected the quantity and quality of *gur* made.[4] No wonder the canes indigenous to North India have been thin, hard and fibrous varieties giving low tonnage of canes and poor juice, though resistant to cold and disease and to water-logging. 13 tons of cane and a trifle over 1 ton of *gur* per acre are all that indigenous canes could yield, though improved varieties—hybrids between the above and the tropical canes—have doubled the yield.

SUITABILITY OF SOUTH INDIAN CLIMATE FOR SUGARCANE

South India, including Mysore, lies entirely within the tropics and is from the point of view of climate much more favourably situated for the growth of sugarcane, on tracts irrigated by channels or wells, than any other part of India. According to the Indian Sugar Committee of 1920 "there can be no question that there is no part of India, except possibly the Deccan Canals tract of Bombay, in which cane can be grown with greater profit than in Madras[5]. Thicker and finer tropical canes, mostly imported varieties, have been grown here and they have generally responded very well to the careful cultivation, regular irrigation and the heavy manuring, characteristic of the garden cultivation of the southern districts. As for the large labour force required for work on fields and in the factory and for transport and of requisite qualities, there is no lack of such human material in South India at rates of wages which would be considered too low in any other country that grows cane.[6] While there is a dearth of such labour in Cuba, Hawaii and Natal, we have in fact a surplus of such labour, part of which has been responsible for the maintenance of sugar plantations in British Guiana, Fiji and Mauritius.

SCOPE FOR IMPROVEMENT

Research work on cane so far as this Province is concerned is yet in its infancy, the Coimbatore Research Station having been established for the evolution of

4. Patwardhan and Apte: Agriculture and Livestock in India, March 1931, p. 177.
5. Report of the Indian Sugar Committee, p. 151.
6. Report of the Imperial Sugarcane Research Conference, pp. 48, 49.

canes suited to the vast sub-tropical areas in North India. We have no doubt incidentally benefited to a slight extent. Some of the famous tropical varieties imported to serve as parents in cross-breeding work have been distributed in Southern India and found quite profitable, though they have given rise to some problems to be tackled. It was quite common to get an average of 25 tons of cane per acre, while the improved varieties have resulted in yields of well over 40 tons, some favoured tracts as in Dharapuram taluk yielding even 60 tons. Mr. Hilson, lately Director of Agriculture, stated "we can grow as heavy crops of cane as any other province and heavier than most." [7] Another important advantage from the point of view of big factory industry that our southern sugarcane districts possess is that cane can be planted and grown so as to be harvested in different parts of the year so as to prolong the period of milling well over 100 days which is the working season in North India.[8]

PAUCITY OF SUGARCANE IN SOUTH INDIA

Why is it, then, that in spite of the above climatic and other advantages that we possess, sugarcane is only a luxury crop in South India and occupies a paltry 100,000 acres cultivated in the Madras Presidency including an area of 11 million irrigated acres. Mysore has a slightly better proportion of sugarcane to her total cultivated area, 36,000 acres out of a total of 6 million acres. This insignificant part that sugarcane plays in the agricultural economy of South India is deplored by all authorities on the subject, though some of them consider it as almost inevitable or unalterable. Dr. C. A. Barber who achieved high distinction by his work on sugarcane in South India states in a recent note on Sugarcane Economics : "It is unfortunate that in Peninsular India, where tropical canes can be grown perfectly well, sugarcane is practically eliminated by rice and other crops which use up all the land and water available." [9] The Indian Sugar Committee of 1920 did not regard the prospects of any considerable extension of sugarcane cultivation in South India as hopeful. The Indian Tariff Board reporting 10 years later had no more optimistic view.

7. Report of the Indian Tariff Board on Sugar Industry, Appendix III.
8. Noel Paton: Sugar in India.
9. Report of the Imperial Sugarcane Research Conference, p. 35.

WIDE DISTRIBUTION OF THE CROP

The difficulties that stand in the way of extension of Sugarcane cultivation in South India deserve a closer study. It is at first necessary to note that owing to the configuration of this province, cane is grown here under a greater variety of conditions of soil, temperature and rainfall than in any other country in the world perhaps, at any rate unlike in the more or less homogeneous Indo-Gangetic valley.[10] We find cane in almost every district in the presidency but the chief producing districts with more than 5,000 acres each, are half a dozen; some are along the sea-coast, some are in the interior; some have plenty of rains, some are very dry; some have flow-irrigation, some have lift irrigation, some are well-drained, some are water-logged. Sugarcane is, by one authority, said to flourish like the cocoanut along the coast, with some 'salt in the air'; in fact the only great exception of a sugarcane tract lying far away from the sea seems to be that of Northern India. But whatever advantage sea coast may confer on canes, it seems to be more than outweighed by the havoc wrought by cyclonic weather particularly on the tall canes in the Godavari delta, the protection against which is the propping up of canes with bamboo stakes at a cost of about Rs. 100 per acre. Sugarcane is taking root in a region of heavy rainfall like South Kanara though soils in the West Coast are as a rule said to be poor in lime and therefore unfit for cane. It is indeed seen at its best in interior districts of scanty rainfall like Coimbatore, Bellary and Chittoor where lift irrigation and manuring are more careful than in the northern districts, where the soil is rich but it is prepared indifferently, setts are broadcast wastefully, and manuring is insufficient. South Arcot presents a unique position as regards cane cultivation, thanks to the very fertile delta, and the high water level which permits easy well-digging; and sugarcane cultivation has been stimulated by the efforts of the East Indian Distilleries and Sugar Factory at Nellikuppam.

SOME NATURAL DIFFICULTIES

This diversity in soil, climate and irrigation facilities and consequently in the conditions of cultivation makes it very difficult to evolve canes suitable to all areas. The breeding of canes suited to tracts so different from one another and the absence of any

10. Report of the Indian Sugar Committee, p. 145.

organisation to spread them are in striking contrast to the ease with which 'the wonder cane of Java', P. O. J. 2878, has been spread in a period of five years over 95 per cent. of the cane area in Java. Apart from the excellence of soils which are of recent volcanic origin, the quantity and distribution of rainfall in Java, owing to its situation near the Equator, are more satisfactory than in any other big cane-growing country; but it is wrong to think that every district in Java is equally favoured with rainfall. In some of the eastern districts where the rainfall is meagre with only 20 rainy days in the year, it is amply supplemented by the never-failing irrigation canals, which being inundation canals carry a lot of silt with them.[11] A good deal of attention is paid to drainage which presents no little difficulty as sugarcane generally follows paddy which is often on the ground when the land has to be prepared for cane growing; this is said to be got over by a deep trenching at one end of the field, while the paddy is being reaped at the other.[12] In our best irrigated tracts, particularly in deltaic tracts of Tanjore and part of Godavari, drainage is a great problem; while water-logging occurs, sugarcane is ruled out or it succumbs to disease. The only crop that the swamp fields tolerate is paddy. On the other hand, a few of our irrigated tracts get the benefit of irrigation throughout the year with little or no interruption, which is essential for the sugarcane crop as it requires watering for 12 months, though the quantity needed may not on the whole be greater than for rice. This is perhaps the reason why the bulk of the cane grown in the Madras Presidency is under 'minor works' of irrigation such as river channels and small tanks for which capital account is not kept or wells and other sources of supply; only 11,000 acres of cane, more than half of them in Godavari, are under 'major works' of irrigation.

PREFERENCE FOR RICE ON ECONOMIC GROUNDS

But even where the soil is suitable and irrigation or drainage presents little difficulty, there is said to be a marked preference for rice in this province and a prejudice against sugarcane which must be traced to certain economic difficulties. Rice, where water is available, is a certain crop, it is comparatively easier to grow, the routine is ingrained in the ryot in the irrigated tract and there is little desire to change to a risky crop like sugarcane. Rice is the

11. Coleman: Sugarcane Cultivation in Java, p. 5.
12. *Ibid.* u. 6.

most important food crop consumed in the neighbourhood in most cases, though it is an export crop in a few deltaic areas, and marketing until recently was not a serious problem, while the keeping quality of rice is incomparably superior to the sugarcane product. The cost of cultivation of sugarcane is several times higher and is beyond the reach of small cultivators. Manuring, in particular, is a costly item all over, while in the Godavari delta wrapping and propping of canes raise the cost to Rs. 400 per acre,[13] and in the interior dry districts the cost of lifting water is equally heavy. Above all the disposal of produce, unless there is a factory demand, is a bug-bear to the ordinary ryot. He has to undertake the uncongenial work of crushing the cane and making of jaggery, except in some tracts where there is an independent agency offering to undertake the work for a definite remuneration. The marketing of the final product with all its fluctuations, due in part to prices of imported sugar, is the crowning difficulty that has deterred the ryot from choosing this crop in place of paddy. In fact the stimulus of higher prices did not in the past invariably lead to an appreciable increase in the area under sugarcane.

In the last two years of unparalleled depression, however, a great change has come over the mentality of agriculturists and in the attitude of the Government. With the tremendous fall in the price of rice, and the protection assured for white sugar industry which must to some extent react on jaggery there has been a hankering after some alternative to paddy.[14] The problem is felt to be all the more urgent as the new irrigation schemes of Mettur in Madras and the Irwin Canal in Mysore are likely to add otherwise nearly three-quarters of a million acres to the area under the unwanted paddy. A more profitable crop than paddy is needed to make the best use of the water that will be charged higher rates than hitherto paid under the old systems. The Government of Mysore has already, as in other spheres, given a distinct lead in the facilities it is offering for the planting of sugarcane among the 120,000 acres that will be irrigated by the Irwin Canal and for the manufacture of jaggery and white sugar on factory scale.

ECONOMIC DIFFICULTIES IN THE WAY OF FACTORY SUGAR PRODUCTION

The Indian Sugar Committee stated that the difficulties in the way of extension of sugarcane area in the South were neither

13. Report of the Indian Tariff Board on Sugar Industry, p. 55.
14. *Ibid.* Appendix II, p. 116.

agricultural nor irrigational, but the problem was entirely economic. They saw little hope of the extension of white sugar manufacture in Madras; and the Indian Tariff Board seemed to be of the same view. A concentrated area of about 2,000 acres at a time (6,000 acres under command if cane is rotated with paddy and a leguminous crop as in Java) is essential for the running of an economic factory with an output of 4,000 tons of white sugar crushing about 50,000 tons of cane per season. The estimated initial capital for such a factory is Rs. 13½ lakhs.[15] The systems of land-tenure and inheritance in this country which favour independent or semi-independent small holders with excessively fragmented holdings are said to be inimical to the control of a large area of production so essential for the fresh and regular supply of canes to the factory. Freshness is of the utmost importance in the case of the manufacture of crystal sugar; delay in the transport of cut canes leads to rapid deterioration of sucrose content in the juice. A 16 miles radius of canes round about the factory is the utmost that can be satisfactorily managed in India. The cost of canes—which amounts to two-thirds of the total cost of production of sugar—should not be as high as it is in the Godavari or Coimbatore district, which ranges from 7 to 12 as. per maund due to cost of propping or lift-irrigation and should be reduced to make it worth while for the factory to operate.[16]

DIFFICULTIES NOT FORMIDABLE

The difficulties stated above do not seem to us to be altogether formidable. The initial capital will not be difficult to find though under the lure of the new tariff it is in North India that most of the 25 recent companies have been floated. Systems of tenure and inheritance are not radically different in North India where a number of factories have been located, while in South Arcot we have the great example set by the East India Distilleries and Sugar Factory at Nellikuppam which began with leasing 40 acres and gradually got control of 2,000 acres, and helped the cultivators with the supply of setts for planting, of water by oil engine pumping from wells, and also advanced money and purchased the whole crop relieving the ryot of the bugbear of jaggery making and marketing.

15. *Ibid.* Appendix III, p. 116.
16. Report of the Indian Tariff Board on Sugar, p. 60.
17. Report of the Indian Sugar Committee, p. 152.

It may not be possible in an old settled country like India to get such complete control of cane cultivation by the factory as has been possible in Java or Formosa, but co-operation between the factory and the agriculturist to their mutual advantage is not impossible. It is beyond the scope of a paper for the Geographical Association to lay down the exact lines on which a 'symbiotic pact' as in Java can be formulated.[18] The cost of cane too is bound to go down very appreciably in South India, with more and more research on canes suited to our climate.

IMPROVEMENTS IN JAGGERY MAKING

If the extension of white sugar manufacture is fraught with difficulties it is well to pay attention to improvements in the crushing of cane and the making of jaggery for which there is yet a considerable demand in spite of the growing taste for white sugar. There is, at present, a considerable loss in the extraction of juice, amounting to 10 per cent., by the iron roller mills driven by bullocks especially as the rollers are often eased off to lighten the work for the bullocks. Oil engine extraction with 6 to 10 H.P. not only gives a larger yield of jaggery and lessens the cost of making it, but a wider adoption of it would release the bullocks from this very hard task to their more proper work on fields. There is likewise loss in the crude boiling of the juice in thick open pans with incomplete combustion.[19] Improved furnaces, for some years advocated by the Department of Agriculture, not merely save fuel but lead to the improvement of the quantity and quality of jaggery.

WHITE SUGAR MAKING ON SMALL SCALE

A new line of improvement, new to this part of the country, now advocated by the Department of Industries is the making of a kind of white sugar (called Khandsari sugar in North India) by centrifugal machines driven by power, of which a description is given in the Tariff Board Report and which has been demonstrated in Coimbatore by the Department. It is within the means of the well-to-do cultivators, and a number of small cultivators too may instal on a co-operative basis power-crushing and making of this white sugar by centrifugals. In fact, twice as much white sugar is made in this way in North India as by all factories put together

18. Report of the Imperial Sugarcane Research Conference, p. 36.
19. Madras Agricultural Department Bulletin.

which manufacture only 100,000 tons. There is no doubt some loss in the recovery of sugar by the Khandsari process but it is more than made up for by the low overhead charges and the smallness of the initial capital required and the easiness of organisation.[20]

This method is indeed strongly recommended by the Indian Tariff Board for parts of the country not yet developed enough for the establishment of central sugar factories. The problem of utilisation of the by-product, molasses, is no doubt serious, though it is sought to be used up to some extent in the manufacture of a second class *gur* by mixing it with fresh cane juice and boiling it. The manufacture of industrial, or power, alcohol in a country so little favoured with coal or oil as South India would be one solution.

But we shall conclude as we may be charged with having already strayed too far into extra-geographical fields. We hope, however, that this brief discussion serves to show that the problem of the influence of environment on economic activities is not all within the province of geographers, pure and simple, and that the co-operation of students of social sciences like economics and sociology is needed. As has been well observed, "Natural data are much more the material than the cause of human development. The 'essential cause' is less nature, with its resources and obstacles, than man himself and his own nature,"[21] which includes his powers of organisation.

DISCUSSION

The address was followed by a brief discussion.

Mr. N. Subrahmanyam asked why the Tanjore delta should not grow sugarcane and whether other sources of sugar like palmyra were not of importance.

Mr. K. C. Ramakrishnan replied that in the Tanjore delta, drainage was a great difficulty; perhaps there was a prospect of sugarcane cultivation in the Pattukkottai taluk which is to be benefitted by the Mettur Scheme of irrigation. As for palmyra

20. Report of the Indian Tariff Board on Sugar Industry, Chap. IV.
21. Foreword to L. Febvre's Geographical Introduction to History.

sugar, he said that Madras Presidency had almost a monopoly, while date-palm in Bengal was an important source of sugar there. There were some advantages in these tree crops, they grew on poor soils and needed less cost and toil to raise and to maintain, and the jaggery prepared from the juice was also available for the refineries attached to sugar mills in the off-season for sugarcane. But this cottage industry of tapping and jaggery-making was by no means in a prosperous condition and did not offer a living wage to workers, while the conversion of juice directly into sugar involved the mills in the organisation of the laborious work of tapping and transporting the juice often long distances to the factory as the palmyra trees were generally scattered and not found together in topes except in parts of one or two districts. Besides, the Indian Sugar Committee noted the disinclination of tree-climbers to give up their hereditary occupation to which a social stigma had been attached. It was needless to speak of the complication due to excise rules and administration which looked with suspicion on the tapping for sweet toddy, as abuse of this for getting fermented toddy was easy.

The Chairman, Mr. V. Ramakrishna, Director of Industries, congratulated the lecturer on the interesting address and proceeded to give an idea of what the Department of Industries was doing to encourage sugarcane cultivation and sugar manufacture on small scale but on improved lines. He believed that the introduction of thinner varieties of cane as in North India, but adapted to our climates, would reduce the cost of cultivation, particularly that of propping. He had great hopes of an expansion of the area under cane and of greater profits to cultivators, if some of the drought-resisting varieties experimented upon proved successful. A great desideratum was the training of young men in sugar technology in some suitable centre in S. India, preferably in S. Arcot, where the Annamalai University may well establish a Sugar Technological Institute as at Cawnpore.

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COIMBATORE

The Sweet Harvest in a Southern Maharashtra Village

By

Mr. S. S. Galatgekar.

The harvest season of every crop is a very busy time in an Indian village, but the busiest and the sprightliest part of the year is when the simple rural folk are employed in crushing sugarcane crop.

Take a round in the village on a spring morning, and you will find the village astrologer surrounded by a group of anxious farmers, whose cane-crop is now ripe and who are making enquiries about an auspicious day on which to begin the crushing operation. The astrologer consults his almanac, and after calculating the planetary positions, fixes upon a day as an auspicious one.

"Oh, no", says the farmer. He wants the astrologer to find out some other day, for he is unable to secure the cane-crushing machinery on that date. So the astrologer finds out another day, auspicious and convenient.

1. Some three months before harvesting the current year's cane, the plot for the following year is ploughed. The old wooden plough is replaced by the modern iron one. In the back-ground is the current year's cane crop.

India is a country where the system of small agricultural holdings prevails, and where the stock-in-trade of an average peasant is very small indeed. He has at his command only simple and cheap agricultural implements which are necessary for his daily work; the costly ones, he must hire or borrow. There are only two or three sets of the cane-crushing apparatus to the credit of each village in the cane-growing district. These sets satisfy the wants of all the village plantations; besides this, the cane farmer has to make arrangements for the set of workers required during the crushing operations. A small village cannot supply more than seven or eight batches of these workers at a time. Considering all these difficulties, it may be said that there can only be, at the most, seven or eight farms being worked at a time in a village. A small plantation requires the set of workers and other materials for three or four days, whereas some are large enough to require the same for about two weeks. After the work on one farm is finished, the set of workers and materials are transferred to another farm; hence the village is occupied with this business for nearly two months.

2. For the purpose of manuring the following year's cane plot, the farmer asks the village shepherd to rest his flock of sheep there for three or four nights. The dung of the cattle is also used for manuring the plot.

As the appointed auspicious day is approaching, the farmer is busy with the preliminary work. He has to get the fuel and the brick-furnace ready. The furnace is a permanent brick structure, which is a large round pit, with a side opening. (See illustration No. 6.). This is used also for storing manure during the year. The most important part of the whole affair is the manufacture of jaggery, a kind of crude sugar, locally known as gur. The juice must be turned into gur, for cane and juice have no

noney value in the case of the village plantation. It is only in he neighbourhood of large towns or the few modern sugar facto-ies that the cane planter can make money by selling his sweet uice.

After getting the fuel and the furnace ready, the farmer plants he crushing machine on the appointed auspicious day, and cele-rates the opening ceremony by a feast to which friends and rela-ives are invited. The number of invitees is quite a large one and he function partakes of a religious as well as a social character. Generally the food consists of boiled rice and wheat pie, stuffed with gram meal and jaggery. It is not too pretentious a fare; it s arranged on the farm itself; the whole gathering squats on na-ure's carpet provided by Mother Earth. Everyone has a brass plate in which the food is served by the hostess and her volunteer helpers. The refreshing breeze of the spring evening, the clear, blue, moon-lit sky, the green crops standing all round, the rustic naidens singing gaily, the children romping about with pieces of pie in their hands, the spirit of *bon homie* that inspires the gather-ng, all these heighten the beauty of the occasion, and surely en-viable is the lot of those that enjoy it! Look at the host in the centre; he does not partake of the feast. Now he leaves his seat and moves about among the guests, extending his hospitality to each individual member.

3 & 4. Canes are stripped and tied up in portable bundles and carried to the crushing mill. The clearing in the cane-plot is covered with heaps of cane-blades.

He looks at the standing cane-crop; his year's labour to be realised in hard cash. On the sweet cane de-nds the way how he will fare materially during the coming ear. The jowar corn he has stored for the year's food supply;

the fodder is stacked to feed the bullocks that have worked so hard to draw the water for the growing sugarcane; the vegetables have been sold to meet sundry wants; the chillies can only bring him a new bullock to fill the place of an invalid one; now sugarcane is the only item on which he can depend for his other needs. His needs are many indeed. He has to pay the land revenue to the Government; he has to pay the rent to the landlord; he has to discharge his liabilities to the Sowcar (the money-lender) from whom he has drawn some advance on the cane-crop; he has to pay interest on a loan incurred during a year of unusual drought. It is on the yield of that green crop, standing proudly, that he hopes to satisfy all these demands. Out of all the crops on his small farm of about 10 acres, the sugarcane is the very soul of his economic life. How can it disappoint him ? He has reared it with paternal care. He will not taste even a single cane, for he thinks it unnatural for him to do so, as he himself has planted it. He has vowed not to taste any cane from his plantation. He entertains the people with a liberal heart and offers some food in the name of God. His heart is warm with feelings and he inwardly prays to God to reward him with a sufficient yield of jaggery.

5. *The Crushing Mill at work.*

An Iron vat is fixed in the ground in front of the person who is putting the cane between the rollers.

The Juice is collected in this vat which is covered with a bamboo strainer, when juice sufficient for one boiling kettle is extracted, the bullocks with their drivers are relieved and another set is employed.

After the festive dinner is over, the crushing operation begins. The small plantation is alive to its core. One person is posted near the crushing mill, where he is quietly putting the cane between the heavy iron rollers. In front of the rollers, an iron vat covered

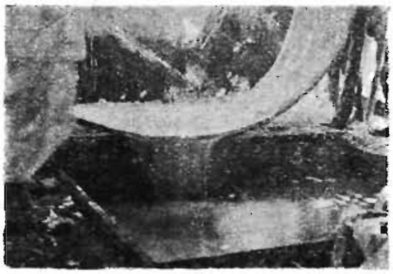
with a strainer is fixed on the ground. In this vat the juice is collected. A wooden shaft is horizontally fixed on the top of the crusher, and to this two pairs of bullocks driven by two drivers are yoked. (See illustration No. 5.). Head loads of cane are brought from the crop-plot to the crushing place. About eight to ten people are busy in the cane-plot; they strip the canes, pluck them, tie them in portable bundles, and carry them to the crushing mill. After a long hot day the tropical moon showers her silvery rays over the surrounding landscape and the group of workers cannot but feel the exhilarating influence of the inspiring environment. Rural poetry and rustic mirth find a spontaneous expression among the cane-pickers and other workers. The bullock drivers relieve the monotony of their rounds by self-composed inspirational songs which warmly eulogise their faithful bullocks. The village wits gather round the warm furnace, and the tobacco pipe passes from mouth to mouth. Another group is chewing the pan leaf and pieces of betel-nut. They are indulging in folklore, love stories, cutting satire, and brilliant repartees, while the elderly group is philosophising on human life. While all the tongues are glibly occupied with stories, ballads, satire, and philosophy, cupid also finds an occasional devotee. An impatient youth riotously sings a love song imploring his imaginary sweetheart; but hark! another roguish youth shouts forth a counter-song suggesting that the heroine has already pledged her love to him.

6. *The boiling kettle on the furnace.*

This brick-structure is a deep round pit, with a side opening. The two men are throwing the fuel through the side opening into the furnace.

From the iron vat in front of the crushing mill, the juice is removed to the boiling kettle on the furnace, which is called in

India, the Karahi. The sturdy yeoman does not feel the heavy weight when he carries the juice-pot on his shoulders. When the juice begins to boil, the clarifying process is done by the gur-maker, who, with a ladle, removes the scum as it collects on the surface. In the boiling-shed the important person is the gur-maker. He is supposed to be an expert whose place cannot be filled by a raw recruit. He is the sole officer in charge of the kettle, and on him depend the colour and quality of the material that makes the mouths of the surrounding idlers water. He determines the proportion of Soda and similar other materials, to be mixed with the juice, to get an improved quality of gur. He watches the kettle with keen concentration, as the process approaches completion; for he is responsible for determining the time when the kettle is to be taken from the furnace. He must do it very carefully, for even a very short delay will spoil the quality of gur. When the hot liquid reaches sufficient thickness in the judgment of this expert, word is passed round to the farmer, who summons 5 or 6 workers to the boiling shed. The kettle has two iron rings on both the sides, through which a strong wooden pole is passed. Three or four persons stand in readiness at either end of the pole, awaiting the signal from the great gur authority. In the most unassuming manner, the authority shouts the word of command, and at once there is a deafening roar from one end of the pole, and an equally deafening response from the other end, to ensure simultaneity in lifting the weight. The kettle is taken



7. After the juice has attained the required thickness, the kettle is taken from the fire, and the hot thick liquid is poured into an iron pan, where it is allowed to cool down. This sweet material is called Gur.

from the fire and the hot liquid is poured into an iron pan close by, where it is allowed to cool down. (See illustration No. 7.). After the gur cools in the pan it is poured into small iron moulds. A

dozen or more of these moulds are kept ready in the boiling shed. A piece of cloth is placed in the mould so as to cover the whole of its interior surface, and then gur is poured into it. One kettle of juice yields gur sufficient to fill three or four such moulds. In the mould it hardens and gets the required shape. After a day or so, the mould is inverted, and when lifted up, leaves behind the lump of hard gur with its cloth cover. The cover is taken off, and you find the hard lump of gur, with a reddish golden hue. Now it has attained the required hardness, colour, and shape, and is a marketable commodity.

8. Pieces of cloth are placed into the iron moulds so as to cover the whole of their interior surface. After the Gur cools in the pan, it is poured into these moulds, where it hardens and gets the required shape. After a day or so, the moulds are inverted, and when lifted up, leave behind lumps of hard Gur with their cloth covers. The covers are taken off, and you find the hard lumps of Gur.

While the gur-making process goes on in the boiling shed, the crushing mill is kept working throughout the night. When the boiling kettle is filled with juice, the bullocks and their drivers are relieved by another set. Thus throughout the night, three kettlefuls of juice are obtained by employing three different sets of bullocks.

In the morning the mill is not continued for a very long time, for the enervating sun overpowers the army of workers, in an hour or two. The cane-pickers stop work, the mill-driving bullocks are relieved, and it is only the gur-expert, who is working with the sweet boiling liquid. In a quarter of an hour, he expects to be free, after the thickened brown material is poured into the iron

pan. The workers go to the adjoining stream for a wash, after the work is stopped. Generally they do not go home for their meals, as the food is brought there by their family people. By 9 o'clock in the morning, the farm road is lined with a throng of people and cattle from the village. You will find the rustic boys with a short stick in one hand and bread wrapped up in a piece of cloth in the other, riding, nay, lying flat with their faces downwards, on the stolid buffaloes. Their brothers are working as cane-pickers in our farmer's plantation and waiting for the breakfast which is being carried by these dutiful urchins. A coy dame is marching in her silent reserve, driving a buffalo in front of her. She is carrying food for her husband who had been putting the canes into the mill throughout the previous night. An old mother is slowly trudging on her way to appease the hunger of her son, who was one of the last night's bullock-drivers. And how many more? Nearly every worker employed in gur business, attracts some one of his family and also his cattle. Is that all ? No; the idlers, the poor, the decrepit, they are all making their way to the sugar-farm. But luckily for our farmer, this group of idlers and beggars learns on the way that gur-making is being carried on in other farms and is distributed amongst all these three plantations. When most of the workers go to rest, and the cane-crushing iron mill is stopped, the stillness of the oppressive April day is relieved by this army of guests who set in motion the human cane-crushing machine. Everyone picks up a piece of cane, and under the refreshing midday shade of a giant pippal or babul tree, begins to suck the cool delicious juice. In the shadow of the boiling shed, by the side of the cane-load near the crushing mill, in the clearing of the cane-plot, wherever you go, you will find that the tempting cane is being relished till the patience of the human gums is put to a severe test. The quadruped guests are also not less responsive to the urge of the surroundings. They are feasting on the heaps of the green cane blades scattered here and there; and they express their appreciation by a look of gratitude and contentment.

Now it is five o'clock in the evening; the enervating sun is going down; and the workers are awake after their noon-day slumber. They will now wash their faces, drink a bowl of juice, draw a puff of smoke, and begin their work. All human energy that was locked up during the hot midday is released in brisk vivacity. The crushing mill begins; the bullocks commence their rounds; the workers are collecting and stripping the canes; in short, the farm is again a bustling hive of men and cattle. As the sun goes

down and down, the gathering becomes more and more representative of the village. The village worthies are invited and respectfully treated with cane, juice, and samples of gur. The village officers, the sowcar, the village school master, the carpenter, the blacksmith, the cobbler, the barber— all lend variety to the gathering. In Indian villages such artisans as the carpenter, the smith, the cobbler, and others are not paid in cash for their services, but they receive their quota from the produce of every crop during the harvest season. When jowar corn is being reaped, they carry home sheaves of the stalk; when it is threshed they are given some corn; when chillies are picked, they are ready with a piece of cloth in which to carry home their share; when the gur season begins, they visit the farm every day. During the continuance of gur manufacture, every day they carry home some canes, cane-blades, and a small potful of juice; and when the farmer completes the gur manufacture he gives a lump of it to each one of them.

It is interesting to reflect that in the heart of the 20th century, there still exist the rural peasant communities, based on relations which remind one of mediaeval feudal society. The village community, with these institutions, carries the mind back through the kaleidoscopic vistas of time to a stage where definite history fades into the realm of romance, fable, and imagination. Through the centuries past, they have survived many foreign invasions and internal disorders; they have witnessed the rise and fall of well-organized and orderly empires; they have enjoyed many a bounty of nature and suffered the curse of famine and disease.

But all these upheavals have left the ancient village organization unshaken in many respects. Until the 19th century, the Indian village was a little commonwealth and a self-sufficient economic unit; but some of the institutions have now either died away or become obsolete in the face of modern civilization.

The village worthies and a few others take leave of the farmer early in the evening; but many remain long into the night. Some poor people depend on the juice and cane for their supper. The morning batch of guests, that had brought food for the workers, leaves the farm in the evening with canes and blades loaded on their buffaloes. The more ambitious among them carry home juice also to sweeten the tongue of some old infirm grandmother. Sometimes a weary traveller comes for a night's rest under an implied invitation from the weird, beckoning light of the boiling furnace. Thus, great is the multitude of visitors who share the hos-

pitality of the cane-farmer. All this waste goes on, from day to day, without a reproof, a frown or even a murmur. The gur season is a time when rural hospitality knows no restraint of arithmetical calculation.

This programme is continued till the whole of the cane-plot is cleared off. Every day nearly three or four kettles of juice are worked up into gur. Each kettle yields from three to four lumps, the weight of an average lump being about 50 lbs. The output of an acre of sugarcane ranges from about 5,000 to 1,000 lbs of gur. The lumps are placed in rows on a bed of dried bagasse in the boiling shed. The farmer has an important function to attend to when the manufacturing process nears its completion. When raw gur is being poured from the pan into the moulds, he must honour the few people who stand near by, with pieces of cloth or small earthen pots. The gur is poured into the earthen pots and cloth pieces, which are then hung up on a peg for an hour or so, during which time it hardens and assumes a round shape. This sweet gift is solicited with importunity by the poor, and presented courteously to the more respectable lookers on. The usual shape and size of the marketable lumps are not followed in the case of the last one or two kettles. The iron moulds are not filled to the brim; the farmer calculates his various liabilities, and casts smaller lumps, which range in size from one-fourth to one-half of an average one. The sweet, yellow-brown gur must be given to the carpenter who has repaired his plough and other farm implements during the year; another lump must be given to the cobbler who has many times patched his hide-skin-bag which is used for drawing water from the well, for the crops; a third lump, to the barber who shaved him and his children ungrudgingly for the whole year. There are many other community servants whose claims must be satisfied, and lumps of appropriate sizes are cast to meet all these requirements. Moreover special lumps must be cast to be distributed amongst the workmen, by way of remuneration for their services during the manufacture. The cane-pickers, the bullock-drivers, the gur-maker, the firemen, are all paid in gur. It is only the owner of the crushing mill who receives his rent in money, and it is interesting to note that the rest of the whole function takes place without a single coin being transferred from one hand to another.

Such indigenous methods are followed, with some modifications, practically all over the country, for ninety per cent. of

India's sugar is manufactured in the form of gur, by individual farmers of small plantations. Figures for the current year show that the total area under cane in India amounts to 2,982,000 acres, more than half of which is concentrated in the upper Ganges valley, a dry region with a high range of temperature. The climatic conditions of the upper Ganges valley are not favourable for the cultivation of the sugarcane, and the yield of cane per acre is therefore smaller than in other damper parts of India. But the rich soil, the Himalayan rivers, and the net-work of the irrigation canals are factors that counter-balance the unfavourable climate, so far as the cost of cultivation is concerned. The average yield of gur per acre in India is estimated to be 1.07 tons; and considering the total area under cane, it may be safely said that the country produces annually more than 3,000,000 tons of gur. Besides this vast quantity of gur, India consumes annually 900,000 tons of white sugar of which 800,000 tons are imported from foreign countries, the rest being manufactured in local factories. Though for the past few years, the Indian sugar manufacturer has been labouring under various difficulties, he has a bright future, pregnant with immense possibilities. The area under cane is increasing every year; the country's demand for white sugar is growing apace; the Legislature has provided protection for the sugar industry; the air is thick with schemes for new sugar manufacturing companies. Thus with these factors in her favour, India hopes to occupy an important place amongst the world's sugar producing countries.

News and Notes

This number opens the Eighth Volume of the Journal; and we are glad to find the increase in the number of our subscribers, both members and institutions. The journal has been considerably improved in quality as well as in size to such an extent that it has not been able to pay its way. We would therefore repeat our appeal to non-journal members to subscribe to our journal and to all teachers to arrange to get the journal for their respective institutions.

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We still feel that non-journal members should be kept in touch with all the activities of the Association; and therefore the experiment will be continued of supplying them with quarterly bulletins containing News and Notes, Reviews, Books and Journals Received, etc.

* * * *

Besides the papers read before the Association either at the headquarters or in one of the branches, an interesting contribution from the Southern Mahratta country on the "Sweet Harvest" in that region, illustrated with pictures, has been included in this number. It is expected that this synthetic and descriptive study will form a new feature of the journal. Similar contributions will be accepted, if they are up to the mark.

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Attention is drawn to the Proceedings of the Annual Meeting published elsewhere. The Seventh Annual Report read and adopted at that meeting has been appended to this number. It records the steady progress of the Association during the year as in the previous years.

* * * *

The penultimate para in the report on the threatened revision of the S. S. L. C. scheme sounds a real note of warning, which ought not to be neglected. It is pleasing to find that educationists and educational associations in the Presidency are up and doing to see to it that the quality of sound secondary education is not lowered in any measure by the deletion of the cultural subjects of the school curriculum such as *Science, History* and *Geography.* We would frankly confess that we are not against any reasonable revision of the existing syllabuses in the concerned subjects to lighten them considerably. What we plead for is the outlook and the training within the irreducible minimum of essentials on the fact side.

Change means time, and in the meanwhile the existing syllabus will continue to be in force. Hints and Comments thereon published serially in the back numbers of the Journal have been gathered together into a pamphlet (Price As. 4 excluding postage) a few copies of which are still available. From the large sale of it the pamphlet seems to meet a felt need.

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But the real foundation for the proper teaching of Geography in the High School has to be laid in the Middle School. The Association has therefore been devoting due attention to the proper geographic training of the secondary grade teacher as in the Refresher Courses last year and this year. In the next number we are proposing to publish a graduated syllabus for the lower and middle schools prepared on modern lines.

* * * *

We are glad to find that the University of Madras is continuing the Diploma Course in Geography for the year 1933-34 also. The classes will be conducted at the Wesley College, Royapettah, as a part-time evening course as in last year. It is hoped that the University will see its way to place it on a permanent basis.

* * * *

While the annual Conferences afford scope for specialised district studies it has been felt for some time that the Association should launch upon fresh activity in the shape of an intensive study of a much smaller region, making a thorough geographic survey of it. The General Body at the last Annual Meeting has consequently appointed a special committee to conduct a Regional Survey of a part of Tiruvallur Taluq as an experimental measure and to serve as a model for similar work elsewhere. This would require the employment of a qualified student of Geography as a whole time worker to gather the data for about a year and to meet his expenses an amount of about Rs. 1,000 will be needed. It is proposed to raise the amount by way of donations and in-aid performances.

* * * *

A donation of Rs. 2 on an average from each of our 400 members will very nearly find the amount. From those that can afford it, a larger amount is expected. The appeal now goes forth to the members, whose sympathetic response is requested. Remittances may be made to the Secretary, stating that the amount is for the "Tiruvallur Regional Survey Fund". Progress of work will be published from time to time in the journal.

Reviews

New Method Illustrated Geographies—Trichinopoly District by M. Krishnamurthy, B.A., L.T., R. C. Training School, Trichinopoly. Published by The Teachers Central Publishing Bureau, Ltd., Madras. Pages 100. Price As. 5.

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This is a vernacular geography book for one of the classes of the lower school prepared on modern lines by a teacher who knows his job. Instead of the usual logical stuff that finds a full place *ad nauseam,* the mentality of the children is here taken note of and the descriptive method is followed, both in the treatment of world geography in the earlier part of the book and in the district study later. One special feature of the book is the number of simplified district maps in which pictorial representation is also combined. It is hoped that the publisher will co-operate with the author and bring out the pictures better.

Geography of India Through Maps by Phyllis Seymour Darling, M.R.S.T. (The Christian Literature Society for India) 1933. 25 pages. 14 outline maps.

This is a companion volume of practical work to Miss Birdseye's *Our Country..* It has been prepared with the three-fold purpose of making the pupils appreciate the significance of geographical facts by working at given data; (2) giving the pupils training in map work as the basis for future geographical study; and (3) affording a sound knowledge of the geography of their motherland. The book can also be used where modern methods of individual work are practised. An important feature of the book is the detachability of the maps, which makes map correlation easy and convenient. The outcome of the use of the book will be to supply the pupils with text-books, containing records of their own work. We would strongly recommend the adaptation of it into the South Indian Vernaculars, if it is to come into general use.

A Geography Note Book—Africa by S. J. B. Whybrow, B.Sc. (Econ. Lond.). Published by J. M. Dent and Sons, Ltd., London. Price 1s. 3d.

This book is one of a series of continental geographies prepared for use in the Middle Schools and upper standards of Elementary Schools. This is also a work whose aim and method are quite modern, the text being learnt side by side with the preparation of outline maps, which bring out separately the various features studied. In fact the author claims as a special merit of the use of the series the formation of the sketch-map habit which is so necessary and handy in the further study of Geography. Though illustrations are expected to be used from the teachers' own collection of pictures, there is a large array of sketch-maps and diagrams to the extent of half the book; while questions, exercises and statistical data give scope for independent work on the part of the pupils. We again wish that the volumes are available in the mother-tongue.

World Atlas of Maps and Pictures (W. and A. K. Johnston, Limited). Price 1s. 9d.

An excellent cheap atlas by the well-known map-publishers, it combines in itself typical world pictures from the Major Natural Regions with letter-press descriptive of the main characteristics of each of these regions. It is in fact a double volume in one. The 32 maps, mostly physical, are simple, clear and free from overcrowding of names, though for use in Indian schools it is desirable that a few sectional maps of India are substituted in place of the separate maps of England, Scotland and Ireland. A useful index and an attractive cover, containing pictorial types of costumes in the several natural regions enhance the value of the volume.

Suggestions for the Teaching of Geography in India by E. A. Macnee, M.A., F.R.G.S., I.E.S.

This brochure is a valuable companion to the middle school teacher of Geography who cannot ordinarily have an opportunity of making a special study of the pedagogy of the subject. In 10 chapters he is helped to understand the scope and appreciate the value of Geography. He is also given an insight into the essentials of the teaching of the subject with due emphasis on (1) the creation of the right geographic outlook and (2) the carrying out of the modern methods of practical work. The language is clear and simple, the book is written from the Indian teacher's point of view and the get-up is neat. A select uptodate bibliography is appended to the volume.

Simple Map Projections by Kazi Said Uddin Ahmed, M.A., LL.B., Lecturer in Geography, Muslim University, Aligarh. Published by the Educational Book House, Civil Lines, Aligarh, U. P. Pages 64.

This neat little volume on Projections forms an easy introduction to the subject. The treatment is simple and clear, and even students with only an elementary knowledge of Mathematics can easily follow it. In dealing with each of the projections, the author points out at the outset the distinctive features of the projections, then explains the mode of construction and finally indicates its properties. Appendices I and II are the most useful for the ordinary High School teacher of Geography; for, the former refers to some common projections used in Atlasses and the latter deals with the identification of projections. The book is profusely illustrated with tables and diagrams, wherever necessary, and well deserves to find a place in every High School and College Library.

Books And Journals Received

Animal Life by Mr. V. R. Doraisami Sastri.
A History of the British Empire by Mr. P. V. Doraisami Iyer.
Middle School Geographies by Mr. M. K. Sundaravaradachari, Books I to III.
Simple Map Projections by Mr. K. S. U. Ahmed.
World Atlas of Maps and Pictures (W. and A. K. Johnston, Ltd.).
Africa (A Geography Note Book) by S. J. B. Whybrow (J. M. Dent and Sons).
New Method Illustrated Geography—Trichinopoly by Mr. M. Krishnamurthi Iyer.
L'Extreme Orient by Mr. Ivar Hallberg.
Suggestions for the Teaching of Geography in India by Mr. E. A. Macnee (Oxford University Press).
Geography of India Through Maps by P. S. Darling. C. L. S.
The Educational Review—Feby., March and April 1933.
The Journal of the Travancore Teachers' Association—Dec. 1932.
The Indian Commerce—Jan. 1933.
Kalaimagal—Feb., March and April 1933.
The Geographical Journal—Feb., March and April 1933
The South Indian Teacher—Feb. and March 1933.
Quarterly Journal of Mythic Society—Jan. 1933.
Tirumalai Sri Venkateswara—Feb. and April 1933.
Mahilamitran (Malayalam)—March 1933.
Journal of Indian History—Dec. 1932.
The Indian Educator—Jan., Feb. and March 1933.
Geography—March 1933.
Wealth and Welfare—April 1933.
Journal of the Andhra Historical Research Society—Jan. 1933.
Our Home Magazine—April 1933.
Indian Journal of Economics—Vol. 13, Part II.
Bulletins of the Madras Government Museum.
Buddhist Sculptures from a Stupa near Goli Village by Mr. T. N. Ramachandran.
Catalogue of the South Indian Hindu Metal Images by Messrs. F. H. Gravely and T. N. Ramachandran.
Adichanallur Skulls by Messrs. Zuckermann and Eliot Smith.
The Sri Vaishnava Brahmins by Dewan Bahadur K. Rangachari.
Catalogue of the Musical Instruments in the Government Museum by Mr. P. Sambamurthy.

Proceedings of the Seventh Annual Meeting of the Madras Geographical Association

The Seventh Annual Meeting of the Association was held at 4-30 p.m. on Saturday the 27th April 1933, at the Presidency College, Madras, with Prof. M. S. Sabhesan,M.A., of the Christian College, in the chair.

I.The Report for the year 1932-33 was read and adopted. (Vide Appendix).

II. The following persons were elected officers and members of the Working Council for the year 1933-34:—

President

Miss E. D. Birdseye, B.Sc.

Vice-Presidents

1. Mr. S. Lakshmana Iyer, B.A., L.T.
2. Mr. M. S. Sabhesan, M.A.
3. Miss J. M. Gerrard, M.A.

Secretary

Mr. N. Subrahmanyam, M.A., L.T., F.R.G.S.

Treasurer

Mr. G. Narayanaswami Iyer, M.A., L.T.

Other Members

1. Mr. George Kuriyan, B.A., B.L., B.Sc.
2. Miss H. T. Scudder, M.A.
3. Mr. B. M. Thirunarayanan, B.A. (Hons.).
4. Mr. P. Venkat Rao, M.A., L.T. (Mofussil Member).

III. Resolved that the Association do place on record their high appreciation of the services rendered to it by (1) M.R.Ry. Rao Saheb T. S. Subrahmania Iyer Avl., as President for three years; (2) by Mr. K. Rangaswami Iyengar as Vice-President; (3) by Mr. C. M. Gopal, as Treasurer; and (4) by Messrs. B. V. Narasinga Rao, R. Dann and Syed Ameeruddin as members of the Working Council.

IV. Resolved that a Committee consisting of the following members with power to co-opt be appointed to conduct a Regional

Survey of a part of Tiruvallur Taluq as suggested in Lt.-Col. Webb's letter, and submit a report, if any:—

1. Miss E. D. Birdseye,
2. „ J. M. Gerrard,
3. „ H. T. Scudder,
4. „ M. W. Barrie,
5. Mr. George Kuriyan,
6. „ B. M. Thirunarayanan,
7. „ T. N. Muthusami, and
8. „ N. Subrahmanyam (convener

V. Resolved that any vacancies, arising in the Committee, be filled by the Working Council.

VI. Resolved that the Working Council be authorised to spend a sum not exceeding Rs. 10 from the funds of the Association towards the preliminary work in connection with the Geographical Survey.

VII. Resolved that Mr. N. Subrahmanyam be the convener and that he be authorised to collect money on behalf of the Association for this purpose and that he be requested to render account to the Association.

The meeting closed with a vote of thanks to the chair.

The Educational Cinemas, Ltd., then gave a show of the following geographical films:—The Epic of Mount Everest, Cotton Growing, The Panama Canal and the London Zoo.

JOURNAL OF
THE MADRAS GEOGRAPHICAL ASSOCIATION

The next number of the Journal (Volume VIII No. 2) will contain the Proceedings of the Fourth Geographical Conference held at Trichinopoly in May last with all the papers read at the Conference.

Back numbers, containing the papers read at the three previous Conferences at Coimbatore, Palghat and Madura, are available at half rates, i.e., at 1 Re. each.

Other back numbers will be given to members at specially reduced rates.

S. S. L. C. Syllabus in Geography with Hints and Comments

BY N. SUBRAHMANYAM, M.A., L.T., F.R.G.S.

(Reprinted from back numbers of the Journal.)

Price 4 annas. Postage **extra.**

Pictures of South Indian Birds

(From a back number of the Journal.)

Price 3 annas. Postage extra.

TIRUVALLUR REGIONAL SURVEY FUND

Members and others interested in the Regional Survey of Tiruvallur as a fresh activity of the Association are requested to subscribe their mite for the purpose. Remittances may be made to The Secretary, The Madras Geographical Association, Gopalapuram, Cathedral Post, Madras.

Members are reminded that the subscription for membership and Journal for the current year (1933-34) has fallen due from 1st April 1933. They are requested to remit it at an early date. Unless the Secretary is informed not to do so, the next number will be sent by V. P. Post to those members whose subscription remains due.

The Journal of
The Madras Geographical Association

Vol. 8. July 1933 No. 2

Proceedings of the 4th Geographical Conference of the Madras Geographical Association, Trichy Session

The Fourth Conference of the Madras Geographical Association commenced its sittings on the afternoon of Tuesday the 16th May 1933 at the Lawley Hall, Trichinopoly, under the presidency of Mr. K. A. Nilakanta Sastri, M.A., Professor of Indian History and Archaeology in the University of Madras.

Besides the following members of the Association, there was a large gathering of visitors:—Messrs. A. K. Krishnaswami Iyer (Madras), T. S. Suryanarayana (Madras), K. Rangaswami Iyengar (Madras), V. Saranath Iyengar (Trichy), K. A. Nilakanta Sastri (Madras), E. S. Radhakrishnan (Trichy), T. S. Anantanarayanan (Lalgudi), M. S. Sabesan (Madras), George Kuriyan (Madras), B. M. Thirunarayanan (Madras), S. T. Ramanujam (Trichy), S. Ramakrishna Avadhani (Trichy), R. Agoram (Tanjore), G. Narayanaswami (Madras), C. S. Rajagopalan (Madras), V. K. Sourirajan (Madras), N. P. Ramanathan (Namakkal), M. Krishnamurthi (Trichy), V. K. Rajagopalan (Chidambaram), N. S. Narasimham (Trichy), S. Natesa Iyer (Pudukottah), P. Natarajan (Pudukottah), R. Krishnaswami Iyer (Pudukottah), V. K. Rajagopalan (Pudukottah), Srinivasa Iyengar (Pudukottah), M. R. Rangaswami Iyengar (Periyakulam), V. S. Ramaswami Iyenger (Madras), J. N. Paramasivan Pillai (Coimbatore), S. Natarajan (Madras), V. Krishnan (Madras), T. S. Sundaram Iyer (Ambasamudram), S. K. Devasikamoni (Trichy), N. Subrahmanyam, Secretary (Madras), P. K. Ramanatha Rao (Chittoor),

S. S. Krishnaswami Iyer (Secunderabad), A. L. Sundaram (Karur), R. S. Srinivasa Iyengar (Karur), V. Pitchu Iyer (Negapatam), N. Achutharaman (Erode), S. Ananthanarayanan (Trichy), K. N. Krishnaswami Iyer (Srirangam), R. Ramakrishnan (Andiyur), N. Rangaswami Iyer (Kumbakonam), S. Srinivasamurthi (Kurnool), C. G. V. Subbiah (Nandyal), N. Divakar Rao (Coonoor), J. Sugirtha Raj (Tuticorin), G. Mahadeva Iyer (Madras), V. Sivasubrahmanyam (Madras), D. Narasimhachari (Madras), R. Srinivasan (Madras), R. Seshagiri Rao (Madras), N. Sitaraman (Batlagundu), C. Visvanadhan (Manamadura), S. Raghunadhan (Madras), G. V. Rama Iyer (Kumbakonam), Vaithinathaswami Iyer (Chidambaram), T. G. Panchapagesa Iyer (Perambalur), V. Garudadri (Devakottah), Seetharama Gupta (Madras), K. S. Seetharama Iyer (Kattuputhur), V. Ramakrishnan (Vizag), A. R. Srinivasa Iyer (Madras), A. S. Ramaswami Iyengar (Srirangam), K. N. Rangaswami Iyer (Srirangam), M. S. Paul (Udayarpalayam), T. D. Govindaswami Pillai (Lalgudi), Lakshmikantham (Vridhachalam), M. Gopala Iyengar (Chidambaram), A. N. Ardhanari (Bhavani), K. N. Subramania Chetty (Edappadi), B. H. Krishna Rao (Vizag), T. K. Kothandaraman (Namakkal), V. Guruswami Sastri (Tirukkattupalli), A. N. Schwartz (Madras).

WELCOME ADDRESS

Mr. Khan Bahadur P. Khalifullah Sahib, M.A., B.L., M.L.C., Chairman of the Reception Committee, delivered the welcome address in the course of which he said that man was a creature of environment, and History is but a study of the activities of man placed in the peculiar geographical conditions of his country and its environment. He was sure that Trichinopoly was not a great puzzle geographically and would give ample scope for study. As far as he was aware, in parts of Perambalur taluk, they had deposits of stone slabs which proved beyond doubt that the area must have been submerged under the sea at one time or other and he learnt on reliable authority that there were clear traces of petrol deposits in the northern part of this district and it was an admitted fact that there were rich mineral deposits in parts of Perambalur and Ariyalur, well worth investigation and research.

They were meeting at a time when there were several changes and alterations of a sweeping character in contemplation by the powers that be. It behoved them to think deeply and deliberate on

everyone of those questions and convey in no unequivocal terms the views of this Conference thereon. It was a matter for deep concern that while subjects of great human interest like History, Geography and Science were accorded a prominent place in the curriculum of studies in several civilised countries of the world, in this country alone due prominence was not attached to the study of Science and Geography. They must be given a place in the 'A' group of subjects, in the S. S. L. C. Scheme, so as to stimulate the interest of the students in their study during at least the Secondary School years.

Mr. S. K. Devasikamani, Headmaster, Bishop Heber High School, proposed Professor Nilakanta Sastri to the Chair. He said that Mr. Sastri was a great educationist of Southern India and a sound critic. They required such a critic to guide their deliberations especially at a time when Geography is about to be disowned.

A time there was, he said, when Geography was like the Cinderella in the story. About three years ago it came to its own in the High School. It was grouped along with History. The circular recently issued by the Director of Public Instruction marked a new era in the study of Geography. Perhaps it may again go down; and they therefore wanted somebody like Mr. Nilakanta Sastri to champion their cause. He was lucid in his speech, had a capacious understanding and incomparable intellect and his wide knowledge of History and Archaeology eminently fitted him to preside over the Conference.

Mr. George Kuriyan of the Department of Geography, Madras University, seconded the proposition. He said that History and Geography had been closely allied subjects for many years; and Professor Nilakanta Sastri as the Head of the Department of Indian History and Archaeology deserved to fill the chair of their Conference.

Mr. M. R. Rangaswami Iyengar, Headmaster, Board High School, Periyakulam, supported the proposition which was duly carried.

Professor Nilakanta Sastri then delivered his presidential address.

PRESIDENTIAL ADDRESS

Less than two years ago, in his retrospect of geographical studies in Britain the Rt. Hon'ble Sir H. J. Mackinder said:

> "About half a century has elapsed since the Council of the Royal Geographical Society came gradually and with some controversy to the conclusion that if it would succeed in reforming geographical education it must transfer its attention from the Schools to the Universities. It was at Oxford, our senior University, that a beginning was made. My memory goes back to my first lecture as University Reader there forty-four years ago. I had an audience of three, one man and two women. The man was a Don who told me he knew the geography of Switzerland, for he had just read Baedeker through from cover to cover. The University of Oxford is now at long last to complete the work of my successors by electing a Professor of the subject with full status and emoluments. In the interval every University in the country has set going the teaching of Geography. Thus, the decision to establish the Oxford Chair comes as the endorsement of a general movement and crowns a national development." (Scott. Geogr. Mag. 1931. Vol. 47, p. 321.)

Geography as an independent subject of study is thus a new creation, and its place in the curriculum of studies and as a subject for research still provides matter for argument.

As a school boy I had a little to do with Geography. I recall that Geography was then, as it still is, an annexe of History: in the early stages, Geography was almost entirely a string of names, of continents, countries, peninsulas, mountains, peaks, rivers, tributaries, towns, and, last but not least, exports-imports: later, there was some talk of seasons, eclipses, tides and so on, and I belonged to a school which made a name for its enterprise in cultivating the newest methods and obtaining the best teaching appliances for Geography. I am afraid these opportunities were wasted on me, and the only thing I recollect of the most advanced Geography classes I attended is my having heard some fine descriptions of natural scenery read out to the class by my teacher. But I do not believe that many students of my generation had equally good opportunities of geographical education: speaking generally, it was the era when exports and imports made up Geography, and dates and events constituted the whole of History.

Geography has been gaining better recognition amongst us in recent years and the work of this Association is to serve as a clearing house of the latest researches in the subject. One of the features of the annual conference of the Association is to take up the detailed regional study of the locality of the meeting, and I have no doubt that, presently, you will be invited to discuss a number of interesting and instructive papers on the Geography of the Trichinopoly Region.

A geographer may feel that the recognition accorded to his subject is still slow, meagre, and half-hearted: it is still History and Geography, much to the detriment of the second member in the unequal combination. In the drama of human evolution, the geographer argues, the theatre has been of equal importance with the actor, and the prevalent partiality for the study of History as against that of Geography is somewhat irrational. I remember the brave efforts our geographers made some time ago to produce a syllabus of Geography for the S. S. L. C. which could hold its own by the side of the histories of England and India taken together: they succeeded better than they knew, and the result is seen now in the disaster that threatens to befall both History and Geography in our secondary education course. The same plan was followed by the enthusiasts for Elementary Science and the consequences are similar.

Though cultivated almost from the beginning of recorded history, Geography has always hovered between a hobby and a science. Parts of it, Cartography and Mathematical Geography for instance, were from the beginning characterised by a great amount of accuracy and certitude and have been steadily improved by generations of workers: the rest was superficial observation and vague descriptions. The new Geography which aspires to the position of an independent science is, as Mackinder has pointed out, a creation of the last half a century.

To one who is not a geographer, some puzzling questions inevitably present themselves on the nature and content of geographical studies. He is tempted to ask if Physical Geography is really more than a loose leaf album of strips torn from the natural sciences and manipulated by each geographer after his own fashion; if Mathematical Geography is not more Mathematics than Geography, and if Human Geography again is not a patchwork of data more systematically treated in Economics, Politics, Medicine

and other sciences. Geography in his view, seems to lack the unity which characterises the subject matter of other sciences, and consequently the geographer, being forced to be the Jack of all Sciences, is master of none.

To such enquiries and doubts the geographer must produce a convincing answer, or the future of his science is imperilled. He may indeed point out that criticism is easier than defence, and that defence even though well founded is often difficult. Of the positive contribution of Geography to human knowledge in one sphere, there can be no question. The task of describing the earth accurately by means of scientifically constructed maps based on travels, surveys, observations and so on is preeminently the work of Geography, and if the geographer had not done it, and done it so well, some one else would have had to do it. Then, the true relation of Geography to the other sciences cannot be understood without realising that the central aim of Geography is the study of the earth as the home of man, of 'the human habitat', of how it affects man and his work and is in turn transformed by these. Mackinder illustrates the position thus: "When I was in Africa", he says, "I remember seeing before me a great billowing slope, clothed with dense forest, dark green and burnished in the sunshine. I entered and traversed that forest for a long day. When I emerged and looked back there was the same forest, and yet to my vision it was not the same, for I could now appreciate its texture: I had not merely sight of it, but insight. So it is with the trained geographer: he starts on the shoulders of the scientific specialists, he traverses his natural regions, and emerges with a new grasp and insight of the world as a whole." (Scott. Geog. Mag. Vol. 47. 1931, pp. 328-9.) But having said this, he is modest enough to add: "This, if I mistake not, will be his essential contribution to the shaping of our human destiny in the not far distant future." Geography to-day resembles Economics in this, that no two Professors will agree on their estimates of the relative importance of the various factors at work in individual cases, with this difference, that Geography has never yet attained even the thin core of doctrine and method on which the economists of the world are generally agreed. Much hard thinking will be needed to effect the synthesis by which the two great branches of Modern Geography, Physical and Human, can be integrated into a united whole: but even here there is no lack of fertile suggestion. It has been pointed out, for instance, that both Physical and Human Geography are essentially "concerned with the carriage and stor-

age of energy on the surface of this earth, and the vehicle is the Protean element, water. Even the lightning is incidental to the cloud, and broadcast music depends on steam or water-power." (Scott. Geog. Mag., p. 334.) This perhaps sounds very much like poetry: but does it not sometimes happen that the poetry of to-day is the science of to-morrow?

I wish to say a word on the relation of Geography to History. Historical Geography is wider than what a historian like Freeman understood by that expression. To him it was only historical topography, in particular the shifting of political frontiers. The new conception of Historical Geography is that of a study of the effects of the surface relief upon political and racial boundaries, upon the whole course of civilisation. While the theoretical conception of the scope of Historical Geography is thus stated easily enough, there is not available as yet any scientific method of working out in detail the positive effects of geographical environment on History. That is the reason why, to the chagrin of the geographer, books on History open with vague, but respectful references to the influence of the Geography of a country on its History, and with more or less satisfactory descriptions of the Physical Geography of the countries to which they relate and for the rest of it, forget all about Geography, except when a battle or a campaign clamours for its mention once again. It is no use blaming the historian for this so long as geographers themselves do not speak with settled convictions or evolve a consistent method of study. So far the historian has not been much impressed by the attempts made by geographers and others to explain the course of History by the geographical environment and changes in it, with the result that he still prefers to build on the surer foundation of archaeology and literature.

Take, for instance, Huntingdon's theory of pulsatory changes in climate. It is a theory which has passed through many changes itself, and I shall sketch its outline from the most recent edition available to me of his *Civilisation and Climate* (1924). Climate, Race and Culture are "the three great factors in determining the conditions of civilisation. As to which of the three is most important it is impossible to say." (p. 387.) In historical times, climate "seems to have undergone a pronounced series of pulsations which have varied in character from one part of the earth to another" (p. 6.) and the effects of these changes have depended on the extent of the resulting departure from the optimum con-

ditions of climate (p. 6.), which vary according to a nation's stage of civilisation, and perhaps also from race to race. (p. 17.) The mechanism of these changes consists in variations in storminess and rainfall, rather than in temperature: a shifting of the areas of cyclonic storms alternately toward and away from the equator. (pp. 9-10.)

Criticism and reflection have led Huntingdon to formulate this theory which is so very different from Koropotkin's simple hypothesis of progressive desiccation. But one may ask if in introducing so many refinements into his theory of the climatic basis of History, Huntingdon has not greatly obscured the issue. Even if one concedes the pulsatory hypothesis without argument, and it will not be forgotten that several geographers do not concede either this hypothesis or the 'blanket theory of climate' used to cover such widely different facts as polyandry in Ladakh and the decline of Ancient Greece, one is at a loss to see what it all means. The effects of climatic changes depend not on the amplitude of such changes, but on the deviations they cause from the optimum climatic conditions. And these latter depend on the stage of civilisation reached and perhaps also on Race. I have a habitual distrust of positive arguments based on the conception of the optimum, for the optimum in the social sciences is not definitely ascertainable, and not definable except in relation to results. And where these very results form the subject of debate, the concept of the optimum can afford no help. Huntingdon is rather impatient with the historians who say that climatic changes are not needed in order to explain the historical facts. He argues that the primary question is whether climatic changes have taken place in historical times, and if they have, the historian is bound to take note of them and enquire into their effect, just as he inquires into the effects of barriers like Alps or of great men like Socrates. (p. 342.) But his own statement that the effects of climatic changes depend on the deviation from optimum climatic conditions caused thereby, that, in plain words, the effects of climatic changes may be great or small according to the circumstances of each individual case, makes it seem less worth while for the historian to pursue so elusive a game.

The historian cannot also help reflecting how little the conditions of physical climate seem to have with such world-historic events like the Reformation or the French Revolution, the Great War or the Russian Revolution, and how much more important

the moral and spiritual climate is in explaining these great occurrences. And if from what he sees more clearly, he makes an inference in relation to what is not so clearly recorded, and concludes that either there were no important climatic changes in historical times, (the case of Geological periods stands on another footing), or if there were, they had not such consequences as to merit the historian's attention, he is probably only following the best course that is yet open to him. His presumption that in the history of civilisation the "Social heritage" counts far more than the physical environment remains unshaken.

I think it was Buckle who first made an elaborate attempt to explain the history of India by the rice-eating propensities of her people. The modern geographer makes a more general effort and has a theory regarding the civilisation of the rice-fields. One of the most remarkable statements of this theory is the chapter on "The Civilisation of Rice Lands" in Huntingdon's *The Human Habitat.* It is not a mere description of the characteristics of rice-civilisation, but an attempt to explain the history of rice-lands in terms of their geographical environment. I have not the time to examine here in detail the amazing contentions and the highly imaginative excursions into pre-history calculated to arrest our attention, but this I will say, that when we come to historical times, it is no longer a case of Geography explaining History and bringing fresh light to it, but of History controlling the thought of the geographer. The chapter concludes with the remarkable statement: "Our purpose here is merely to point out that in the past, and perhaps in the future, the conditions that favour the greatest density of population and the greatest aggregations of human beings are those which make rice cultivation feasible for people with tropical appetites, desires and modes of living, and yet with a high degree of culture according to tropical standards." The climate, in other words, which is good for rice, also necessarily makes for low economic standards and a conservative social system. To me this looks more like propaganda and less like science. It is quite possible to explain much of the present backwardness of the tropics in terms of human action which has nothing more to do with climate than with the Binomial theorem; and Huntingdon makes not the slightest attempt to allow for these factors and to determine the residue that may, if at all, be attributed to climate, which at one time did not stand in the way of some countries in the tropics reaching a relatively high culture, not merely according to a tropical, but by a more absolute standard.

Let me point to another instance of the alliance between Geography and propaganda. This time I choose my example from a definitely propagandist book. For the benefit of an American audience whom he addressed in 1930, Lord Meston began his discourse on the origin and growth of Hinduism: "permeating our general conceptions of bygone India must be that of a country singularly isolated and absorbent, with few entrances and practically no exits. In Europe the ancient world was one of much racial movement and migration; the mediaeval world was busy with the comings and goings of soldiers and adventurers, travellers and scholars, for whom national boundaries were of small account. Not so with India. There was no continental interchange of men and thought. Almost a continent in itself, its land frontiers were great mountain masses, the loftiest and densest of this globe, while elsewhere the unknown terrors of the ocean guarded it. Into this pocket on the earth's surface there flowed wave after wave of human race—not to recede again—but to soak into the soil . . . . It lived in seclusion, in itself and for itself, churning over and over for centuries, under enervating skies, its own speculations on life and eternity. No cleansing winds of outside thought swept through the galleries of the mind".* In this tirade on India's isolation, Lord Meston grudgingly admits that there was some commerce by sea with the west and that we hear of occasional missions of western courts; but this intercourse with the outer world was all, according to his Lordship, very partial and spasmodic.

A mountain and a sea frontier are not the monopoly of India, and in sober truth they did not act as barriers to foreign intercourse more than they did in other countries, Italy for instance, and in the eyes of the historian, the isolation of India was never so pronounced as in recent historical times after the advent of the European nations on her soil. Much recent work in archaeology, philology and anthropology is calculated to show with increasing distinctness the place of Indian culture in a belt of closely related and freely communicating cultures spreading across the whole of Southern India and the Pacific ocean, and to bear down the superficial estimate of India's isolation held by the last generation of India's historians. A perusal of works like Hudson's *Europe and China* or Ferrand's *Textes Arabes etc.*, bearing on the trade of the Indian ocean for many successive centuries will

* Nationhood for India (Oxford 1931), pp. 1-2.

show how regular and important were the contacts India maintained with the countries to the West and East of her. Stein's explorations on the one side, and the work carried out by the Dutch and French archaeological departments in the East Indies and Indo-China reveal the wide range and firm hold of Indian influence on the cultures of foreign lands.

Now my object in dwelling at some length on the limits of Historical Geography is not to argue that the historian has no interest in geographical studies or that the geographer should make no attempt to explain historical facts from geographical environment. Geography is a young science and it is perhaps difficult for any science in its adolescence to resist the temptation to be flighty and meretricious. Geography must beware of going too far, and asserting much more than it can, with the data in its possession, prove to the satisfaction of fellow-workers in other fields. When all is said, Geography is a science of things and at the other end of the pole is Man; the geographical outlook is apt to stress the influence of the environment too much, and unduly neglect the various human influences at work to transform the environment and overcome obstacles presented by it. Any suggestion that this privilege of humanity depends upon Latitude or Longitude cannot be received with too much caution. Geography is no stranger to exact and scientific methods in some of its branches and no one dreams of calling into question the great achievement of Geography on these lines. But in all that relates to human character and History, the geographer has perhaps unconsciously, been too often the plaything of accident or prejudice. With patience, a scrupulous regard for objective data, and readiness to allow for the play of extra-geographical influences on the problem on hand, better results will no doubt be reached. Historical Geography is an exacting study; the continuous action and reaction between environment and human progress is the most difficult aspect of dynamic human geography; and the problem is always complicated by the presence of the imponderable considerations attaching to race.

Of the teaching of Geography in our schools I cannot hope to say much, or indeed anything, that is likely to interest you. With your leave, however, I wish to make one general observation. I am tempted to make it for two reasons. First, I believe that there is a real need for a radical change in our methods of teaching not only of Geography, but of most of our school sub-

jects. It seems to me that our practice makes education too much of a process of stuffing the mind and too little of what it should be, a process of drawing out the latent capacity of the mind. We must put a stop at the earliest opportunity and as completely as possible to the phenomena of the teacher who lacks a full view of his subject and gets up 'notes' from day to day on the successive heads of a heavy syllabus, and of the pupil assiduously 'getting up' these notes for the examination. Secondly, the question of the content of our secondary education course is becoming a serious problem, and the authorities in charge of the secondary course appear to me to be embarking on a reform which, in the name of "freedom in education", seems calculated to maim the secondary course hopelessly. Geography loses heavily in the change and so does History.

We have short memories. Not many years ago, the cry was against the premature specialism of the old S. S. L. C. Course and for an all round general education. I believed in that plea then, and nothing has happened to change my belief. I must say this, however, that when we came to grips with the details, we saw that the enthusiasm of specialists outran the pupils' capacity for assimilation; and the demands of the men of science, that the pupils who seek scientific education in the University must have a special preparation for it at the school stage, had to be met somehow. We got a somewhat overloaded group of five compulsory subjects, and a single optional subject, literary or scientific for pupils seeking entrance to the University, that is, in practice, for every pupil, for there is none so mean as not to aspire for a University degree. Now the pendulum swings back to the old position, three compulsory subjects and two options. I am afraid that this course, if decided upon, would leave our secondary education course still in a position of unstable equilibrium, and we may be up against the whole problem in the course of a few years; for in this country, public opinion has a way of being somnolent at the proper time when reforms are on the anvil, and of beginning to kick against them just a little too late.

With the rapid increase of factual knowledge on all hands, the problem of the content of the school course is becoming increasingly difficult of solution in all countries of the world. Ours is not by any means the only country where the school curriculum is the battle ground of specialists, each sincerely actuated by the firm conviction that no education can be complete which does not

give a good grounding in his subject. But we have other difficulties besides. Our elementary schools are hopelessly backward, and in one word, we do not get our money's worth even for the small expenditure on this branch of our educational system; our secondary schools do not recruit pupils coming out of well managed schools, and we have no system of efficient and compulsory education to the age of fourteen on which the high school course may be built. And despite the option to teach through the mother tongue, our teachers still prefer the English medium for the bulk of their work, a medium which does not conduce to the comfort of either teacher or pupil.

It seems to me that to attain a proper balance in our high school course, we must not cut down the content so drastically as to confine the compulsory part of the course to the three R's and then give the choice of any two odd bits from a wide range of science and arts subjects. The better method seems to be to do away with the single optional subject and use the time so released not to intensify the training in the general subjects, but to introduce the much needed variety and interest in the school programme in the form of options with a vocational and technical bias. In the general and compulsory part of the course, there must be worked out a reasonable syllabus in each subject and an attempt made to diminish the strain of the examination. The aim of the syllabus in each subject must be to bring the pupil into intimate contact with a selected part of the subject; and equip him with the capacity and the desire to carry his studies further on his own. For this, more than the syllabus, the method of its treatment in the class-room counts. The teachers must be able to furnish skilful guidance through the subject-matter which lies before the pupil and teach him to put his time to the best use. And the type of examination must be such as will test, not the capacity to memorise and repeat facts at proper notice, but the general ability of the pupil and the extent to which he had been able to assimilate the subjects in his course and make them part of his permanent mental equipment.

I believe that experts in Geography, if they feel that there is something in what I have said, can and will contribute their quota towards improvements along such lines. It is with some diffidence that I commend to your consideration the method suggested by the following description of the teaching of Geography in a German school of to-day: "A class of twelve-year-old boys has recently

returned from a journey to the island of Sylt in the North Sea. There the thirty-eight lads spent two weeks with their teacher, who is continuing to use those common experiences in class work. On the walls of the room are many maps, sketches, and paintings made by the pupils during or after the trip. A picture-map of the journey down the Elbe River, a topographical map of the island, and other diagrams showing the region and route followed were made at home by the pupils after they had been given some instruction in the technique of enlarging maps accurately. There are many drawings and paintings of fish seen in the markets and in the waters around the island. A record of the tidal stages was kept during their stay at the seashore. A number of stories of camp life and descriptions of the trip have been written voluntarily."

SECRETARY'S REPORT

After the Presidential Address was over, Mr. N. Subrahmanyam, Secretary of the Association, then presented his report. He said:—It has been usual for the last three or four years at each Conference for the Secretary just to make a short retrospect of the work of the Association and speak about its progress. In the District of Trichinopoly in which our Conference is now being held we have sometimes plenty of members; sometimes there is a paucity in membership; at any rate for the public, the Geographical Association and its work may not be as well known as it ought to be.

The Association is now beginning its eighth year of existence; and it has been running its journal these eight years as a quarterly with a variety of aims and objects. The objects of the Association as published in the rules are: (1) to promote geographical knowledge, (2) to secure for Geography its proper place in the High Schools, the University and its constituent and affiliated colleges, (3) to help to improve the methods of teaching Geography, (4) to work for a School of Geography being started and (5) to promote regional studies about South India from various points of view.

All the foregoing aims and objects had been kept in view these years and some of them have borne fruit in fair measure. To promote geographical knowledge and to promote regional studies of South India have been the two most prominent, however,

and with these aims before us we have had a number of papers published in the Journal of the Association from time to time; and for the last four years we have been having conferences of this kind. Probably this year we will be having a short business session also. But till now it has been purely an academic conference. It was four years ago that we started this new activity of the Association at Coimbatore under the protecting wings of the S. I. T. U. For we thought it would conduce to the mutual benefit of the members of the S. I. T. U. as well as to those of the Madras Geographical Association to meet more or less simultaneously.

The main aim of the Conference has been to make a regional study of the particular district in which the S. I. T. U. Conference meets. The second Conference was held in Malabar, the third in Madura and this is the fourth.

The other aim, to help to improve the methods of teaching Geography, was kept steadily in view all these years and Summer Schools have been conducted—the fifth of which was held during the last two weeks at this very place under the joint auspices of the Geographical Association and the Provincial Educational Conference.

To secure for Geography its proper place in the Universities and their affiliated colleges, there has been a good deal of propaganda done both on the platform and in the Press as well as through the Journal of the Association. But there is once more need for doing such propaganda to avoid what we may regard as another calamity that threatens the position of Geography in the Secondary School.

The aim of starting a School of Geography has also been kept in view from the outset, and the University was persuaded directly and indirectly so that we have now a Department of Geography established in the Madras University. Though it is now kept on a temporary basis, it is hoped that this Department will soon be placed on a permanent footing.

As usual, we have received this year also quite a number of papers and I do not know how many of them could be read and discussed; but all will appear in a special number of the Journal, containing the proceedings of the Conference.

A message from M.R.Ry. Rao Sahib T. S. Subramania Aiyar, wishing the Conference every success, was next read by the Secretary.

A paper on *The Population of the Trichinopoly District* by Mr. B. M. Tirunarayanan, B.A. Hons. (London), was then read and discussed. (All the papers on the Trichy District with the discussions will be published in the next number of the Journal.) The Conference then adjourned for the day.

It re-assembled on the afternoon of the second day (17-5-33) at the Saraswathi Hall, National College, and devoted well-nigh two hours in the reading of papers and discussions thereon.

The papers read in this session were the following:—*The Meteorology of the Trichinopoly District* by Mr. B. G. Narayan, B.Sc., of the Kodaikanal Observatory; *The Influence of the Physical Features of the Trichinopoly District on the History, Communications and Economic Conditions of the area* by Mr. C. A. Krishnamurthi Rao, M.A., of the Madura College; *The Urban Geography of Trichinopoly and Srirangam* by Mr. R. Dann, Director of Town Planning, Madras; *Fairs, Festivals and Shandies* by Mr. V. Krishnan, M.A., Dip. in Geo.

In the intervals between the sessions members went on excursions in separate parties to the Golden Rock Railway Workshop, Grand Anicut, Upper Anicut and other places of importance in the neighbourhood.

The concluding session of the Conference was held at the Saraswathi Hall on the afternoon of Thursday the 18th May, when the following three papers were read and discussed:—*Mediaeval Town-Planning in India* by Mr. C. A. Krishnamurthi Rao; *Place-Names of the Trichinopoly District* by Mr. S. K. Devasikhamani, B.A., L.T., Headmaster of the Bishop Heber College; and a paper on *Human Geography* by Mr. T. S. Sundaram Aiyar, B.A., Geography Assistant of Ambasamudram High School.

For want of time, the following papers were taken as read:—*Physical Geography of the Trichinopoly District* by Mr. T. N. Muthuswami Aiyar, M.A., L.T., of the Engineering College, Guindy; *Soils and Products of the Trichinopoly District* by Mr. P. R. Anantarama Aiyar of Board High School, Lalgudi; *Economic Geography of Udayarpalayam Taluk* by Mr. M. S. Paul

f Board Secondary School, Udayarpalayam; *The Agricultural Geography of the Trichinopoly District* by Mr. A. S. Rajamanikam, M.A., University Research Fellow in Geography; *Communi-ation-lines and Town-sites of the Trichinopoly District* by Mr. N. Subrahmanyam, M.A., L.T., F.R.G.S.; *Lalgudi and its Environs* by Mr. T. S. Anantanarayana Aiyar, B.A., L.T., of Board High School, Lalgudi; *The Urban Geography of Karur* by Mr. A. L. Sundaram, B.A., L.T., of Municipal High School, Karur; and *The Cauvery Delta and the Kallars* by Mr. J. S. Ponniah, M.A., of American College, Madura.

RESOLUTIONS

Two resolutions were then placed before the Conference for adoption. Mr. Sastriar took the opinion of the House, after reading the resolutions, as to whether or not they were non-controversial and having found the House agreed that they were non-controversial and with the approval of the House moved them himself and they were carried unanimously. The resolutions were in the following terms: —

"This Conference is of opinion that Geography should not be deleted from the compulsory A Group in the S. S. L. C. course, as in any system of sound Secondary Education Geography should find a place as a natural link between the Sciences and the Humanities."

"With a view to help the growth of scientific study of Geography in all its aspects in this Presidency, this Conference recommends that each High School in this Province should make arrangements to record the daily temperature, pressure and rainfall and direction of wind in its locality and report the same every month to the Madras Geographical Association for consolidation and report in the Journal of the Association.

CHAIRMAN'S CONCLUDING REMARKS

In bringing the proceedings to a close, the Chairman made a few remarks on the work of the Conference and the possible lines of improvement. But before doing so, he said he must give expression to his feelings of gratefulness and thanks to Mr. Subramania Aiyar and the Geographical Association for the opportunity given to preside at that session and to learn so much that was of profit and pleasure to him.

There was an advantage as well as also some disadvantage, Mr. Sastriar proceeded to say, in a conference of that kind being

held at the same time as other conferences of a similar nature. Both the advantages and disadvantages were very obvious. The advantage was that the Conference did not stand by itself but became one of a group of like conferences and the chances of social and intellectual intercourse were secured to them. But the disadvantages were that they had to suit their sessions very carefully, time them so as not to trench on the time taken up by other conferences. And in that matter the Geographical Conference which was quasi-technical in character suffered a real disadvantage because the chances of discussion got considerably minimised. He had felt the inconvenience himself. But he did not wish to be understood to say that the disadvantages outweigh the advantages of the arrangements under which they were now working. He hoped it would be possible for them in the coming years to device some means by which they could retain the advantages which they now had and go very far to minimise the disadvantages and handicaps. One of the main things required for that was that papers to be read at the Conference should be submitted to the Secretary by the prescribed date and the Secretary also would have to make it a rule to insist on that rule being observed. And then the Secretary will get an idea of the resources of the Conference and secondly it was also desirable that contributors should make it a point to attend the Conference also and participate in the discussions.

Mr. Sastriar regretted that as a conference in the present session they had devoted so little to problems of Geography teaching, of which there remained so many that called for answer and solution. But he did not want to dwell only on their shortcomings. He did so obviously with a view that the Conference, as it was, was good, and that he only wished it to be better. He had no doubt that in the coming years the sessions would improve in the directions he had indicated and each session of the Conference would mean a substantial addition to the stock of knowledge of the Geography of the Province. The papers that were being published year after year, they would see, constitute very valuable studies of the Regional Geography of the area in which the Conference assembles. He hoped that in the coming years there would be real, brisk and lively intellectual exchange so to say of ideas and thoughts such as could be had only on such occasions.

He had nothing more to say, Mr. Sastriar concluded, except to congratulate Mr. Subramania Aiyar on the excellent success which had attended the work as the organiser of the Geographical

Association and the successive Geographical Conferences. Just at the moment, perhaps, Mr. Subramania Aiyar was not as cheerful as he might be because there was some fear of Geography being thrown into the background in the S. S. L. C. course. But he would promise Mr. Subramania Aiyar and he was sure Mr. Devasikhamani would do likewise with him that they would do their best to stand by him and avert the danger. (Cheers.) He must also underline here, Mr. Sastri humourously remarked, the undertaking which Mr. Subramania Aiyar gave and that was that on his part he would co-operate with them in producing a reasonable Geography syllabus; for it was not a secret that a heavy syllabus was a handicap and the present S. S. L. C. Scheme has been criticised very much on that score and it needed looking into.

Mr. K. R. Avadhani, Vice-Chairman of the Reception Committee, proposed a vote of thanks to the President who he said had guided their deliberations with patience, tact and humour which came to the rescue of tense situations. He also proposed a vote of thanks to Mr. Subramania Aiyar who had proved himself to be the soul of the organisation and without whose sage advice and guidance the Reception Committee could not have performed their task with success. He also thanked the authorities of the St. Joseph's College and the National College for placing their buildings at the disposal of their Conference members.

Mr. N. Subramania Aiyar, Secretary of the Association, added his thanks to the President and to all those others who contributed not a little to the success of the present session. It was gratifying to note that as many as 75 members of the Geographical Association attended the present session as against only 30 that attended the Madura Conference last year. Members had come from Vizagapatam, Kurnool and Nandyal. It was also pleasing to note that the Mysore Government itself had deputed a representative to attend the Conference. He could not just then say where their next Conference would be held. The choice seemed to lie with three places, Tanjore, Salem and Anantapur. But whichever it was, it did not matter; for any place was welcome for making geographical studies; and he would in conclusion only assure their President that he would take his suggestions and work accordingly.

Mr. Nilakanta Sastriar was garlanded amidst cheers, and the Conference concluded.

(All the papers on Trichy District read and discussed at the Conference will be published in the next number of the Journal.)

Human Geography

By

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WHAT IT IS

Geography deals with a large number of phenomena connected with the earth, viz., structure and relief of land, atmospheric conditions, plant and animal life, man and his various activities such as, mining, manufacture, commerce and communication. The greater number of these phenomena are in no way influenced by human activities. " Whether man exists or not, water will evaporate under the heat of the sun, and air charged with vapour, when driven against a mountain wall, will rise, expand and cool causing precipitation. Whether man exists or not runnning water will carve valleys, and the detritus carried along by the waters of streams will tend to spread out in alluvial cones or deltas as soon as the force that carries it weakens. Whether man exists or not, the glaciers will smooth their rough beds, wind bearing grains of sand will sculpture the rocks of the desert and sea-waves will cause the cliffs to crumble." In fact the whole surface of the earth shows changes due to the various denuding agents that have worked upon it.

A considerable part of plant and animal life also escapes the influence of man; for the earth would be covered with vegetation and peopled with animals even if man did not exist. All these facts form the foundation of *physical*, or *scientific side* of Geography.

Besides these, we find, on the surface of the earth, a new and very extensive series of phenomena: groups of human beings, villages and towns, roads, railways and canals, cultivated fields and irrigated channels, domesticated animals, quarries, etc. All these facts in which human activity has a part form a truly special group of surface phenomena—" a

* A paper read at the Fourth Geographical Conference held at Trichy.

complex group of facts, always within the limits of Physical Geography but having always the easily discernible characteristic of being related more or less directly to man." To the study of this specific group of geographical phenomena the name "*Human Geography*" is applied.

THE TWO ASPECTS OF HUMAN GEOGRAPHY

This *human geography* has two aspects :—

(1) Man's life is dependent upon his environment; i.e., his food, clothing and mode of life depend upon the physical features, climate and productions of the surrounding region.

(2) Natural features are modified by man's action; i.e., where nature is not favourable to him, man is able to conquer her and subdue her.

Let us now try to illustrate what we mean by these two aspects.

THE FIRST ASPECT

Let us first take the *tundra* which is a belt of frozen swamps along the Arctic coast. In summer the earth thaws only to a depth of less than two feet; hence agriculture is impossible and no food crops can be raised. But fish are found in the seas and rivers, and a few fur bearing animals on the outskirts of the forests in the south; so people have to live by fishing and hunting. The only useful animal that thrives here is the reindeer which lives on the moss that is found under the snow. It is the chief support of the scattered families that live here. It provides milk and meat for food, skin for clothing, horn or bone for tools and sinews for cord or thread. The reindeers wander freely in search of food, and so they have to be followed by their owner and his family. Hence the people of the tundra lead a *nomadic* life, and therefore they live in tents. Life is very hard and precarious; hence the old, the sick and the superfluous children are very often left to starve and perish. Thus we see that man's food, clothing, mode of living and his attitude towards his relations and fellow creatures are all affected by his environment.

In the Arctic Islands of North America and along the shores of the mainland live the *Eskimos*. Here the physical and climatic

conditions are the same as those of the Asiatic tundra. The Eskimos also live by fishing and hunting. They have no reindeer, but have eskimo dogs to draw their sledges. Men, women and children are all clothed in fur. In summer the Eskimos live in portable skin tents, but in winter they live in ice-houses, called *igloos*. The people do not wash themselves often, as water is hard to get except by melting the snow. Mothers often remove the dirt from the faces of their children by licking.

In the *steppes* or grasslands, the people are shepherds who pasture great herds of cattle, sheep, goats, horses and camels. When these animals eat a given area bare, they move to another place; hence the people of the steppe also lead a nomadic life. They live in convenient and comfortable round tents which can be opened in sunshine and closed in storm; but for winter they build houses and stables near a water supply. Meat, butter, cheese and milk form their chief food. They carry on important home industries such as the making of camel's hair cloth, carpets, rugs and hair-cushions. As food supply is greater here than in the tundra, the old and the sick are not left to perish. To tend and water large herds, a large number of people are required; hence the head of a family sometimes takes more than one wife.

In the *desert* nothing grows for want of moisture, even though the soil is fertile. But in the oases, agriculture and pasturing are possible; hence people lead a settled life there. In other places they are nomads. The camel is the chief beast of burden, for its feet are suited to walking on sand, and it can remain without food and drink for a long time. The Bedouin Arabs who are also tent-dwellers, live by guiding caravans or giving their camels for hire. They are sometimes driven to the necessity of plundering the caravans as food is scarce.

In *agricultural* areas, man cultivates the land and lives upon the produce got from it. Here the necessity for wandering ceases and fixed homes are made. People have leisure to observe and think, and have developed in all the arts of civilisation. It is remarkable that the great civilisations of the world have developed in the fertile river valleys of the temperate and sub-tropical regions. In China, the north of India, Mesopotamia, Egypt, Greece, Italy and later in temperate Europe and America, nations have advanced to high degrees of civilisation. Here nature gave abundant supplies, but demanded some effort, some observation and labour. The time and energy left to the peoples of

these regions enabled them to pursue the higher ambitions that go to make great nations. But in the equatorial regions, the luxuriant plant and animal life left neither room nor inclination for such activity. Hence people there are still primitive.

In the equatorial regions where temperature is very high and rainfall abundant, the plains are unhealthy and almost invariably fatal to the Europeans, and dangerous even to the natives. Hence, people had to seek more favourable regions on mountains and plateaus where at an elevation of more than 6500 feet the air is in general keen, dry and salubrious, and resources permitting people to subsist are not lacking: e.g., South America, Mexico, plateaus of Iran and Abyssinia. Whereas the lofty plateaus of these countries have become rallying points of human establishments, those of temperate lands like Europe have a restraining influence. On the whole plateau countries are thinly peopled, for they are not easy of access. Very high altitudes produce mountain sickness due to rarefaction of the air and the lack of oxygen. Out of three children born in a white family at Potosi scarcely more than one survives beyond a few hours. "Those who reach man's estate are able to form only a puny and stunted population."

The nature of the plant that is cultivated in a place depends upon the soil and water supply that are to be found there. In the southern districts of our Presidency, for instance the Tinnevelley District, paddy (a wet crop) is cultivated in the river valley where there is facility for canal irrigation. On the red soils beyond the river valley where water is obtained from rain or well irrigation, dry crops, like millets, pulses and oil-seeds are raised, and in the black soil area cotton is grown. Rice is largely cultivated in Bengal and wheat in the Punjab. Why? This is due to the different climatic conditions required by the two plants. Rice requires great heat and a good supply of water both of which are to be found in Bengal, while wheat requires a drier and a cooler climate than rice; hence it is grown as a winter crop in the Punjab and is harvested in early summer which is sufficiently warm and dry to ripen it. Owing to the change of seasons and the geographical distribution of the different wheat-growing regions, there is always some spot on the earth where wheat is being gathered and threshed.

Millions of cattle and sheep are being raised on the great *grasslands* of the world, there being more cattle than sheep on

the tropical grasslands and more sheep than cattle on the temperate grasslands; but on the *pampas* of Argentina the number of cattle has increased while that of sheep has decreased.

Man not only cultivates plants and raises animals, but also *devastates them.* This economic plunder is intensely practised in the zone comprised between 36° and 56° North latitude where the most advanced civilisation is concentrated. In the plant kingdom, man's devastating activity is carried on particularly in forested regions. Forest devastation is especially the work of civilisation. This is because timber no longer seems to be indispensable as it was for long centuries. Coal or coke is used for warming; houses are built with iron, brick and concrete; locomotives of countries like Russia which used wood now burn petroleum. But to the modern industrial world wood is more than ever indispensable. It is used in mines, for railroad ties, posts for telegraph, telephone and electric power wires and for paving streets. Wood pulp is used for making paper. Hence in the lumber region of Canada, in order to keep up the future timber supply, a day is set apart each year when children plant young trees. In the tropical countries devastation makes its worst attack upon rubber. As there is an evergrowing industrial demand for rubber, in all European equatorial colonies an attempt is being made to develop cultivated rubber.

Man may kill animals for food and clothing. He will be raising them and not devastating them, if he takes care to provide for their reproduction. It is not devastation if as a result of increase of population, man restricts the sphere of animals. He has also a right to exterminate injurious animals. Hunting becomes devastation when he attacks animals that are not injurious. Many birds are killed for feathers for the purpose of feminine adornment. In temperate forests animals are hunted or trapped for their fur. The elephant is threatened for its ivory. It is already rare in the savannas and in the forests of Central Africa. " The hour of its complete disappearance will come with the establishment of better means of communication." The slaughter of seals and whales is the most disastrous devastation of the animal kingdom in the seas. Fishing in rivers and lakes is another form of animal devastation. But in many countries laws are being enacted to keep this devastation in check.

In *coastal regions* people are engaged in fishing, and hence fish form an important part of the diet of the people. Such people

get the *sea-habit,* and become good sailors. This paves the way for their becoming maritime nations, e.g., Great Britain and Japan.

In *mineral* areas people are engaged in mining and extracting the metals from their ores. In places where the coal and iron are found together or in close proximity, iron works are established as the Tata Iron and Steel Works at Tatanagar (Jamshedpur). The value of coal lies not only in the fact that it is used in the smelting of iron but also in the fact that it is used to convert water into steam which forms an important motive power. After the invention of steam-power, all factories have been established either on the coal-fields, or very near to them. In fact, in England, almost all the important industrial centres are on the coal fields.

There are two types of industrial cities; one born above and from the coal, e.g., Newcastle and Manchester; and the other (historically greater) powerful enough to summon coal to it and to transform itself into an industrial centre in spite of its distance from coal, e.g., London, Madras. In all manufacturing centres people crowd together, and the houses, unable to spread out in width, rise in the air, e.g., New York, Chicago.

Again, the location of a particular industry in a town, depends on the raw material that is available near it e.g. the cotton industry of Bombay and the jute industry of Calcutta.

The use of coal as motive power cannot continue for ever; for coal is likely to be exhausted sooner or later. Petroleum has an advantage over coal; for it can be easily carried in pipes over distances of many miles to the places where it is required. Both coal and petroleum will be exhausted, and so their place is to be taken by another source of power, *viz.*, waterfall, or "white coal."

Mineral exploitation is also a kind of devastation, and this sometimes has a happy result. With the exhaustion of the mines comes poverty, and large groups of people find themselves forced to turn to more permanent occupations. In California the discovery of gold in 1849 led to a gold rush of great intensity. To-day the resources of soil and forests are of greater importance than the mineral products.

When a country produces anything in excess of what is required for its own people, it naturally wishes to sell it to others who may require it, and tries to buy things that it cannot grow

or make and that its people are in need of. This leads to *trade* between one country and another.

Foreign trade establishes the necessity for *sea-ports.* These come into existence only where there is a natural harbour as in the case of Bombay and Calcutta. They acquire importance if they are the natural outlets of rich hinterlands. Calcutta has for its hinterland the whole of the Ganges and Brahmaputra valley where rice, jute, cotton, sugarcane and tea are grown. Karachi has the rich wheat lands of the Punjab behind it, and Bombay, the great Black-Cotton area. Madras has no natural harbour ; but on account of its political importance it has been made a port by the construction of an artificial harbour.

Cheap and quick *means of communication* are necessary to take products from one region to another. With the development of roads and railways, new lands in the interior of a country or continent become accessible. Roads are constructed to connect human settlements ; and later on human settlements are formed along the roads. That is why it is said that the city creates the road, and the road in its turn creates the city. The development of the resources of a country is governed by the degree of ease with which its men can communicate quickly and cheaply with those who live far away. In modern times sea and railway routes are important. Countries near the sea coast have a greater advantage for foreign trade than inland countries. Navigable rivers too play an important part in inland communication.

Railways are at first constructed in places where they can be easily and cheaply made, i.e., where the country is flat, e.g., the Indo-Gangetic valley and the East Coastal plain of India. In mountainous areas, the lines are taken through natural passes, e.g., the Palghat Gap.

Towns are products of settlement ; and settlement is decided by (1) regular food and water supply, and (2) security from invasion by hostile tribes. Hence towns are generally located on the banks of rivers. They may be at the junction of two rivers or near a ford. Where a river is obstructed by a fall or rapid, a break in the transport of goods becomes necessary and a town is formed. All the towns on the fall line east of the Appalachian Mountains are due to this cause, and in modern times they acquire

additional importance as they derive power from the falls. Peshawar is located near a mountain pass, because it can not only defend it, but also command the trade passing through it. In deserts, towns are formed on the oases, especially when they are the meeting places of caravan routes, e.g., Damascus, Timbukto. All railway centres become big towns. The importance of Kolar, Tatanagar, Tavoy, Kalgoorlie and Kimberley is all due to the minerals that are mined near them. Where there are natural harbours, ports are formed. A natural harbour may be (1) a fiord (Trondjem in Norway), (2) a drowned valley (New York, San Francisco), (3) a river mouth (Calcutta, Rangoon), (4) an island harbour (Bombay, Honk Kong), (5) an atoll (Suva in Fiji Islands), or (6) a submerged crater (Lyttleton in New Zealand).

A definite political interest may create an entirely artificial establishment. Aden is in an environment so inhospitable that all fresh water has to be brought by sea ; but it is jealously guarded by England as it occupies a strategic position. An intense historical life may maintain a city in an environment which is geographically abnormal. Jerusalem possesses but two little insignificant springs, but its history attracts there 40,000 inhabitants.

From all we have said, we can see that almost all human activities are governed by natural causes.

THE SECOND ASPECT

We shall now see how Nature has been tamed and subjected to man's will and changed to suit his ends.

Man, when he finds that his own country cannot accommodate all the people in it, emigrates to foreign lands where there is room for him. Even if that foreign land is not climatically suited to him, he is able to create the necessary conveniences, but he does not stay there permanently. If the climate is suitable to him, he makes the new land his permanent home. It is the white men of Western and Southern Europe that have emigrated largely to foreign countries. In the hot wet tropical regions they clear the forests and have plantations, e.g., tea in Ceylon and India, rubber in Malaya, coffee in Brazil, cacao in West Africa. In all these areas white man is subject to diseases like malaria and other

fevers. He is able to manage his business there with his advanced ideas of sanitation and knowledge of medicine.

He lives even in deserts and in very cold places if only he has his means of living there. At Kalgoorlie in the West Australian desert where the mean annual rainfall is less than 8 inches and at Dawson City in the Yukon Valley where the January mean temperature is —24° Fahrenheit, man lives because gold is mined there. The West Australian mining centres get their water supply by means of pipes from a reservior 1313 feet high to which water is raised from a west coast river through nine pumping stations. Thousands of workmen labour in the mills under the burning sun. But the mining population lives about the mine in temporary dwellings. It is a vast camp, a temporary refuge for a population which will scatter when the last veins are exhausted.

In South America, North Chile which is a desert has a large supply of nitrate which is used as a fertiliser for the fields of the world. The nitrate industry has given rise to certain towns along the sea coast to which food and drinking water have to be brought in ships. Now water is brought to Antofagasta by means of pipes from the distant Andes.

In the plateau of Peru there is a mining place called Cerro de Pasco at a height of 14,280 feet in an excessively rigorous climate. The ordinary phenomena of life cease here : " no child is born, the llamas do not bear young, even hens will not lay eggs." Even in such a place man manages to live because silver is obtained there.

Again, if in a new country man finds the native plants and animals useless to him as in Australia, he destroys those plants and animals, and introduces new plants and animals that are useful to him. When the first settlers came to Australia, there were no food plants, and the animals were not useful either for ploughing or for draught purposes. Therefore the settlers brought from their own country wheat and other cereals and cattle, sheep, pigs and other useful animals.

In the prairies of North America and in the pampas of South America the bison and the guanaco have been replaced by cattle and sheep. In these areas millions of cattle and sheep are slaughtered, and frozen meat and meat extract are exported.

Man's conquest of Nature can be grouped under four heads: (1) the Redemption of the Thirsty Land; (2) the reclamation of land from water; (3) the harnessing of water for industrial purposes, and (4) solving the transport problem.

THE REDEMPTION OF THE THIRSTY LAND

Rain does not fall in all places in the world; and in many places where it falls, it is either insufficient as in north-western India, or uncertain as in the Dekhan, or confined to only a few months in the year as in the south-east of our presidency. In such places land cannot be cultivated without the help of *irrigation.* In fact irrigation has completely altered the face of the Punjab and has converted barren wastes into fertile fields of wheat and rice. Where there are no rivers, wells and tanks are used.

Millions of cubic yards of water from the great life-giving rivers run to waste in the sea without benefiting the land at all. It is imperative to stop this waste, especially in a practically rainless land or land where rain is uncertain or insufficient. Hence barrages and dams have to be constructed across rivers. In India the Punjab, the Upper Gangetic Basin and the deltaic regions of the east-flowing rivers of Dekhan have many irrigation works. By the Sutlej valley canals irrigation is provided for enormous tracts in the Punjab as well as in the states of Bahawalpur and Bikaner which are on the desert border. The construction of weirs and thousands of miles of main and distributory canals will naturally affect the Indus in Sind; hence the Sukkur Barrage, the largest in the world has been constructed. It is estimated that in future 30 million pounds worth of crops will grow annually in Sind.

The Periyar Project in the Madras Presidency is an important irrigation work. A dam has been built across the Periyar (a small river in the Travancore territory flowing into the Arabian Sea) and the stored-up water has been led to the eastern side of the Western Ghats through a tunnel under it. It is this water that makes a large part of the Madura District fertile. The other irrigation works in our country are at Kannambadi (Mysore), Bhandhardhara (Bombay) and Mettur (Madras). The last-named *is still under construction.*

The Roosevelt Dam in America, the Assuan and Sennar Dams in the Nile Valley and the Burrin Juck Dam across the Murrumbridge in Australia are examples outside India.

In Eastern Australia almost a thousand artesian bores have been drilled, and they are of immense value for watering stock, though it is doubtful if they are an economic source of water supply for irrigation. Before the sinking of these Artesian wells, as many as 8 million sheep have been known to have perished in a single year of drought. Now these wells are furnishing a steady supply of water at all seasons.

The oases in the Sahara desert are natural " artesian wells "; only the water does not spout up. In the Algerian Sahara the French have created oases by sinking of artesian wells.

RECLAMATION OF LAND FROM SEA AND MARSH

A large extent of land (over 1,200 square miles) has been reclaimed from the Fens of England which were in the 17th century a wilderness of bogs, pools and reed shoals. The Netherlands afford the best example for the reclamation of land from fen and sea. It is said that every year about 40 square miles are being reclaimed. The low fens have been divided into small basins by means of dykes, and these have been converted into pasture lands by draining the stagnant water by steam engines or windmills. It is chiefly to these operations that Northern Holland owes its enormous cattle-rearing industry.

The sea-polders are formed by the gradual accumulation of silt on the outside of the sea dykes. Plants thriving in salt water consolidate this silt, and then other plants are allowed to grow. These plants form good pasture for cattle, the ground is then enclosed and protected against the encroachment of the sea. These sea-polders are for the most part drained at low tide. Thus the Netherlanders, by their struggle against Nature, have acquired territory for an additional half million population.

Very recently the historic achievement of separating the Zuyder Zee from the North Sea by means of a huge dyke was accomplished. Over half a million acres of land have been added to the country. This increases the area of the Netherlands by 7 per cent, while giving an addition of arable land equal to 10 per

cent of that now available. The ground in the drained area is so soft that all farming machinery has to be fitted with " caterpillars."

In our own country the Back Bay Scheme in Bombay proved a failure ; however, some land is every day being reclaimed from the back-waters of the west coast, especially between Alleppey and Cochin, but the method employed is somewhat primitive.

HARNESSING WATER FOR INDUSTRIAL PURPOSES

We have already referred to the use of coal and petroleum as motive power. Both these are likely to be exhausted sooner or later. Hence their place is to be taken by water. This water power is directly used to turn turbines as in the case of the cotton mills at Papanasam, Tinnevelly District, or it is used to create electricity as in the case of the Sivasamudram Falls in Mysore. With the help of this electricity the Kolar Gold mines are worked, and the city of Bangalore is lighted. The Pykara Scheme undertaken by the Madras Government has been completed and will supply electricity to nearly half a dozen districts.

The Tata Hydro Electric Works in Bombay are supplying electricity to the city of Bombay not only to light the lamps but also to drive the cotton mills. By these works an immense quantity of water which before ran uselessly to the sea is made to do a great deal of useful work.

The Mandi scheme, another important hydro-electric work in our country has recently been opened. In America, in the countries of Central Europe, in Norway and Sweden, and in Japan there are several hydro-electric works. Many million tons of coal can be saved by utilizing water power. It is estimated that 200 million horse power (1 h.p. = 5 men's work) is available in the rivers and waterfalls of the world, but so far only 25 million h.p. has been harnessed for use. Thus we see that the Age of Coal is being succeeded by the Age of Water power.

SOLVING THE TRANSPORT PROBLEM.

Man includes not only the ordinary man, the settler and the agriculturist, but also the extraordinary man—the scientific man,

the inventor and the engineer. The engineering skill of man is well manifested in all the irrigation and hydro-electric works. It is also visible in all his attempts to solve the transport problem.

Just as land has been reclaimed from water, it has been drowned by the agency of man. The Suez canal built at a cost of £ 20 million is now 101 miles long, 36 to 39 feet deep, 148 to 195 ft. wide at the bottom and 400 to 460 ft. between the banks. By means of powerful electric lights ships can now pass as safely by night as by day. The saving of distance from London to Bombay is about 5,000 miles.

A more wonderful ship canal is the Panama canal. It is only 50 miles long between the Atlantic and the Pacific, but in making it the waters of the River Chagres have been blocked by building up a dam 1½ miles long and nearly half a mile wide at its base, rising to 105 ft. above sea level. Thus a lake has been created. The science of medicine has helped engineering. The war against the mosquito has been fought and won. Other features of the canal are the two sets of locks one at each end, and the Culebra cut for 9 miles. The saving of distance by sea from New York to Sanfrancisco is nearly 8,000 miles. In many cases water transport has encroached upon land transport. Besides the great isthmus canals, the Great Canadian canals are good examples. Manchester has become a seaport on account of it ship canal. The Clyde river which in 1758 was only 15 inches deep at Glasgow is now capable of giving access to ocean-going vessels of large draught up to the city. In fact almost all the rivers of the civilised countries have been wonderfully transformed by the hand of man.

In India there are very few ship canals. The Ganges canal is used both for irrigation and navigation. The Buckingham canal of our Presidency is purely a navigation canal; but it is navigable only for small country boats.

Four kinds of barriers are set up by nature on land—mountains, forests, deserts and rivers. The mountain is tunnelled through; the forest is cleared; the desert is reclaimed; and the river is bridged.

Motor cars with wheels fitted with caterpillars are used to cross the desert. Wonderful tunnels have been made through the Alps—Mount Cenis (7½ miles), St. Gotthard (9½ miles) and Simplon (12½ miles). Engineers can do wonders if they are well supplied with capital. The Callao—Lima—Oroya—Cerro de Pasco

(S. America) line has 63 tunnels and in a distance of 86.9 miles rises 12,220 feet. In London railways pass through tunnels under the Thames, and in New York three are overhead railways. It is proposed to make a railway tunnel under the St. of Dover. The impossibility of to-day may become the commonplace of to-morrow. In connection with the Indian Mail, to avoid all trans-shipments across the St. of Dover, an entire train is run upon the deck of a properly adapted vessel called a ferry boat. In fact, all attempts to solve the transport problem are to diminish the time taken to cover long distances.

The development of the railway and steamship services led to the *telegraph* and *telephone* services. In all the great towns the telephone has partly superseded the telegraph as a means of speedy communication locally and with distant towns. *Submarine cables* link up the shores of the oceans. The twentieth century has seen the installation of *wireless* and *air services.*

There is now regular airmail service between London and Karachi, and the time of transit is a week. Attempts are being made to reduce the time. This service has been extended to Madras and Calcutta. The Karachi-Calcutta service may be extended to Rangoon and thence it may be linked up with the Australian service via Singapore and the East Indies.

Thus the elimination of distance, the greatest revolution in human life, is going on apace. Steadily and surely the world is becoming one continent; but the colour problem is becoming a most difficult and dangerous barrier to this. It has to be solved before man can think of making the world one continent.

From what we have said, we can see that the world is not as made by nature, but it is being "subdued, replenished recast and contracted by man." Formerly the richest countries were those in which nature was most bountiful; now the richest countries are those in which man is most active.

The Geographical Interpretation of History*

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The conception of History as a science is of very recent growth. Early historians, with a few rare exceptions, thought their business was merely to narrate events and to enliven them here and there with accounts of prodigies and portents, moral reflections and political platitudes. They were mainly concerned with recording what had happened and that too in relation to dynasties of kings and hierarchies of saints and prophets. They hardly knew the value of other branches of learning as an aid to historical investigations. Their works were didactic in essence and parochial in outlook, and were dominated by political or religious considerations. Under these circumstances it was hardly possible for them to see an inter-relation between historical facts and geographical phenomena.

With the dawn of scientific historical studies in Europe during the nineteenth century, there came into existence not only a comprehensive view about the essential nature of the contents of History but also a widening of the scope of research in its investigation. Historical works no longer remained confined to an account of the fortunes of great men, but also they began to take into consideration the life of the people in its varied aspects. With this change in the purpose of history, an era of research was inaugurated and great savants began to spend much of their time in unearthing the antiquities of every kind, and using the results of researches in Archaeology, Geology, Philology, Geography, etc., in solving the complex riddle of human affairs. Bolder spirits among them went further than mere recording the true facts and tried to discover, on the analogy of other sciences, the laws that fundamentally influenced human action. They were not satisfied with the knowledge of *what* happened without the equally valuable knowledge of *why* they so happened.

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* Summary of a lecture delivered at the Vizagapatam Branch of the Madras Geographical Association.

But like all pioneering works, the initial efforts of the scholars in this line produced most divergent views on the influence of Geography on History; and one writer said that "monotheism is the product of the desert". This is as absurd an assertion as that of Karl Marx that the Reformation was the product of bourgeois capitalism. The greater flaw in the position of such scholars is that they were carried away by their pet theories and unduly emphasised the bearing of one factor upon History to the exclusion of all others. At present the more thoughtful historians are recognising that no single factor can explain the varied fortunes of mankind. Hence in historical studies, Carlyle's theory of the omnipotence of personality, Ratzel's theory of the rigid control of natural conditions on human activities, Marx's exclusively economic and Hegel's purely idealistic or spiritual interpretation have been either considerably modified or totally rejected by more critically minded thinkers. Buckle recognised that life is conditioned by an environment and is not an abstraction for metaphysics. He did not, as is generally believed, make food, soil and climate dominate all history. He distinctly stated that "the advance of European civilisation is characterised by diminishing influence of physical laws and an increasing influence of mental laws."

However, it is now accepted on all hands that History is not merely a statement of all the events that ever happened but also a record of the vicissitudes of mankind and the causes that influenced them in the progress or retrogression such as his surroundings. Personality and environment are the two factors of the everlasting fabric which hangs upon time's loom. No historical problem can be adequately interpreted independent of its surroundings.

If there is one single factor which influenced the course of history *to a large extent*, it is the geographical environment. Geography has been affecting human conduct since the advent of man upon this planet. The extent of that remarkable influence is to be seen more clearly in an early stage of society when man had least control over nature. Yet geographical influence can be traced on all the activities of man from the racial migrations of antiquity down to the modern democratic institutions and international relations. In order to understand why there are racial and institutional differences among various people, why the countries which were foremost in civilisation at one time are not counted among

the nations of the world to-day, why the history of the world has been one prolonged record of conflict among various states, or similar other problems, we must rely upon the geographical interpretation of History. This interpretation depends on a correct understanding of the influence of Geography on History.

Geography influences the course of History either by the changes it undergoes through the ages or by its assisting conditions. Past History cannot be truly explained by present maps and charts, howsoever scientifically they might have been prepared. The sacred books of the Hindus, the Persians and the Jews contain allusions to the cataclysmal changes that have overtaken the world ten millennia ago. Scholars have discovered that the epoch-making migration of the Proto-Aryans from the Arctic regions or the Central Asian Plateau was the result of such a cataclysm. Geologists tell us that the world is not what it had been millions of years ago. The present Mediterranean, Caspian and Black seas or the Indian ocean have been the outcome of great upheavals in the physical world. There are reasons to believe that many thousand years ago dry land connected the north-eastern corner of Asia with the north-western corner of America. Such conditions must necessarily have affected the movements of the people and their cultures, microscopic traces of which are to be found to this day. The enigma of the now extinct Maya civilisation of Yucatan and Guatemala might be solved some day by the discovery of the physical connection between the Mexican lands and the other parts of the world. That there have been immense changes in the physical characteristics of land and sea, and such changes have influenced the course of history is now beyond doubt. Even during the period of which we have accurate knowledge there have been alterations in the physical condition of the earth's surface. Fertile lands have changed into deserts, and rivers have either disappeared or shifted their beds, resulting in the depopulation of large tracts of country. The desiccation of the Central Asian lands was the cause of those ethnic waves that at one time flooded the European and Indian plains. Nearer home, we know that one huge river system based on the extinct Hakra, has wholly disappeared, and that the Indus and its tributaries are not flowing in their ancient beds. Unless the reality and the extent of such changes are constantly borne in mind past histories cannot be understood.

Geographical conditions, even without the changes of the type noticed above, have been influencing the course of history

in more than one way, and we will now notice its effects on certain important aspects of human life.

1. *Geography determined the position of early human 'Settlement,' and created the peoples of the world.*—In ancient times oceans, rivers, mountains and deserts proved unsurmountable impediments to the free migration of man from one part of the world to another. Human beings like water took the line of least resistance, so that the segregation by natural barriers resulted in the production of varied types of humanity and culture. Languages crystalised on their individual lines which further segregated one people from another, and created group consciousness so that even to-day with all the ideas of equality of men and all the facilities of communication, the individuality of the "peoples" persists. This can be illustrated by examples drawn from almost any part of the world. For thousands of years the Negroes of ~~America~~ Africa remained isolated from the more civilized world due to the Sahara desert in the north and the surrounding oceans on the remaining three sides. In India the Himalayas acted as a check to the intermingling of the Mongolian and Aryan cultures. The incomplete Aryanisation of South India was mainly due to the Vindya range of hills and the Mahakantara forest.

2. *The physical barriers also determined the size of the early states.* This again finds ample illustration in the history of the world. The city-states of Greece and Rome and the innumerable small states in India were the direct result of the difficulties of communication from one part of the country to another. The attempts of Hannibal, Alexander, Chandragupta Mourya and Samudragupta to build up extensive empires achieved no permanent results due to geographical impediments. The physical contours of India made her an empire breaker. So long as Science did not conquer Nature, the territorial conquests of great military leaders remain only a dream.

3. *Climate, food and soil determined the growth of early civilizations.*.—Rise and growth of civilization depends upon the accumulation of wealth, and the latter is dependent upon favourable physical conditions. In the words of Buckle "as long as every man is engaged in collecting the materials necessary for his own subsistence, there will be neither leisure nor taste for higher pursuits. If what a people consume is always exactly equal to what they possess there will be no residue" to main-

tain a leisured class to attend to social improvements. Thus Geography explains the backwardness of the Eskimoes of the extreme cold regions or the Negritoes of the extreme hot regions. The ancient civilizations of Egypt, Babylonia, Assyria, Greece, Rome, China and India were not the results of accident. The situation of these countries in the temperate zone between the latitudes of 25 degrees and 54 degrees called forth greater abundance of natural productions, and gave an impetus to a wider range of mental activities on the part of their inhabitants. Protected by deserts, seas and mountains, well watered by great rivers, and having room for expansion under a genial climate, the valleys of the Nile, of the Euphrates and the Tigris, of the Tiber and the Po, of the Hwang-Ho and the Yangtse-Kiang, and of the Indus and the Ganges became the radiating centres of civilization in the ancient world.

But those very geographical factors which contributed to the early development of these countries also brought about their fall. Their natural protection filled their inhabitants with so much self-confidence, and their genial climate and rich resources bred in them such a luxurious life and spirit of *laissez-faire* that they easily fell when less civilized but hardy tribes found their way to these countries. It is known to all how the Roman and the Greek civilizations were shaken to the foundation by the inroads of the Goths, the Vandals, the Franks, and the Huns. Even the Great Wall of China proved a broken reed when the nomads of Central Asia determined to exploit with the Chinese the natural resources of their country.

Of course the barbarians soon absorbed the civilization of the conquered and evolved even organized kingdoms and empires, so that those very ancient lands, with their favourable geographical conditions, continued to retain their leadership of the world in culture and wealth till the dawn of the modern oceanic era. The Semitic, Mongol and Tartar hordes, which had remained in semi-barbarous state in their uncongenial native land, when once they settled within this fertile zone, became founders of great monarchies in China, India and Persia, and attained a civilization in no way inferior to that of the people whom they conquered.

With the discovery of the sea-routes, the centre of gravity of the civilizations shifted from the ancient countries like Rome,

Greece, China and India to the countries like Portugal, Spain, England, Holland, France and Japan. Here also Geography determined which country should have a start and which should ultimately take the leadership of the world. It is not without significance that the age of discoveries and oceanic transport was started by Portugal and Spain which abutted on the Atlantic But the continental countries including Spain and Portugal, could not persevere in the race due to their land connections, and insular England carried off the palm.

4. *Geographical influences on the growth of political institutions.* Bury says " The political history of all countries is in some measure under the influence of geography ; but in Greece Geography made itself pre-eminently felt." The mountains and valleys of Greece and the adjoining archipelago were largely responsible for the growth of small communities, which made direct democracy possible. Somewhat similar influence of Geography in moulding the political life of a people can be traced in the history of other countries. England, protected on all sides by the sea, had not much to depend on standing armies for her protection during her early History. Her Kings mainly relied upon the militia for her national defence, and hence they could not establish despotism. France with a long land frontier to defend against the continental foes had a large military force at her disposal which could be utilised to crush the liberties of her people. Thus Geography gives a clue to the evolution of the divergent forms of government in England and France before the French Revolution. In the case of India too the geographical interpretation of her political history holds good. Till the discovery of the sea-routes, the north-western passes supplied the keynote to Indian politics. India being nearer the dry steppes of Central Asia, the home of the nomads, than either Europe or China, thousands of invaders streamed into Northern India through these passes and made stable central government impossible. The rich alluvial plain of Hindustan was easily accessible through them to the steppeland peoples of Iran and Turan. Those who guarded the passes often acquired so much power that they could easily overthrow the ruling power of Hindustan. Every revolution in the Sultanate of Delhi was either brought about by a foreign invader or by the Wardens of the Marches on the north-west. The necessity of maintaining a large force to protect the country from the foreign foe also resulted

in India, as elsewhere, in the evolution of a despotic form of Government.

5. *Growth of sea-power is also conditioned by the Geographical environment of a country.*—Among the ancient nations, land dominated the sea. India, Persia and China, with their extensive sea-boards, could not establish supremacy over the seas for two obvious reasons. Firstly their fertile soil supplied the people with all the necessaries of life, and they were not in need of securing them from abroad; and secondly, they were always open to attack from the north-west and hence they had to concentrate their attention upon the army rather than the navy. Countries, adversely affected by Geographical forces, especially insular lands, were compelled to acquire a mastery over the high seas. It is noteworthy that mighty empire-builders like Xerxes, Kublai Khan and Napoleon were successfully overthrown by the small sea-states of Athens, Japan and England.

6. Similarly an investigation into *the Geographical background of various events* will show them in their true perspective. Nearly all the epoch-making movements of Europe were generated to a great extent as the result of Geographical position. For example, Italy grew immensely rich during the period of the Crusades, so that the Italian cities could easily welcome back their lost heritage of Greco-Roman civilization and thus start the Renaissance movement. The Protestant movement in Germany or the Great Revolutionary movement in France had also its share of Geographical factor in its genesis.

To conclude, the Geographical phenomena are not the sole arbiters of all the human affairs of the world. But they do have a profound influence on the course of history. Historical studies devoid of the Geographical background would be unscientific and inaccurate.

The Study of Geography in Schools*

By

Mrs. P. S. Sundara Raj, M.R.S.T.,

A change is coming over the whole teaching world. Fashions change, even in schools. The dull grind of learning by rote was succeeded by the Play Way ; the lectures gave place to the individual assignment ; the ancient strongholds of classical learning were assailed, and Science held to be the only thing worth teaching in an Age of Science. So, grammar books were cast aside and test-tubes became all-important—only generally it was the teacher who handled the test-tube, while the class stood at a respectful distance where they could not damage the apparatus. There was great talk about the bookishness of education ; vocational training had a great vogue, and it still has its devotees, who seemingly think that schools exist to manufacture carpenters and clerks, factory hands and captains of industry. All these systems have their day ; and there is a grain of truth hidden in each one of them.

What we know as Geography is something equally new. In this country it still has to justify itself and obtain proper recognition. Every geography teacher must of necessity be a pioneer—at least for some years to come. It is well for us now and then to take stock of our position ; to justify the faith that is in us and to formulate at least to ourselves the principles and objectives of our work. Otherwise, Geography teaching itself may come to be classed among the fads and fashions that seem to afflict the teaching profession; and the recognition so hardly won may be withdrawn again.

There is another point to consider also. I have referred already to some of the many developments and tendencies of recent educational method ; some of them were worth little, and soon had to be abandoned ; others have made a permanent contribution to our schools. In recent months another tendency has made itself felt, and in some respects it is a surprising one. We have come to

* Inaugural address delivered to the Geography Section of the Teachers' Association, Teachers' College, Saidapet.

consider this as the age of the expert, the expert being, according to one definition, the person who knows more and more about less and less. Specialisation has been on the increase in schools; and the more specialists a school had on its staff, the more fortunate the pupils were supposed to be. Now a reaction has set in; and while the expert specialist still has his place, it is beginning to be doubted whether his place is in the school. A certain amount of specialisation is good: we want language teachers and science teachers and physical instructors; and most people do not combine all these—but within these broad classes, the specialist is beginning to totter on his throne. The world asks now that school should be a preparation for life; and the universe we live in impinges upon us at every point. As Jeans so forcibly puts it, "we cannot lift a finger without disturbing all the stars." At the same time, we are members of the natural world—we are only natural science specimens—and we have the physical instincts and desires and needs of the animal world to which we belong. But beyond this we belong to a moral and spiritual order, and our souls reach out beyond material needs through art and through religion, through all those mental activities and spiritual promptings which differentiate us from our relatives in the animal world. We all use language, whether we have a degree in it or not; we must eat, though we cannot be experts in dietetics; every time we rise from a chair or walk a step we set in motion a whole series of processes in mechanics and physics, of which we have probably never heard. Such a list might be infinitely extended.

The modern curriculum is seeking to present, not English and French, Physics and Chemistry, Botany and Zoology, but life: not isolated subjects but a co-ordinated whole. Some of you no doubt are Geography specialists: no doubt you are congratulating yourself on choosing a subject which until lately had no specialists. There ought to be plenty of scope for you. But the world changes quickly, and even a Geography specialist may find himself out of date unless he can adapt himself to a new order in which the part is subordinated to the whole. In a science book recently received from Canada, setting out a general science course approved by the Government and written expressly for the Minister of Education, I find a whole section given up to what I used to think was Geography. The whole book deals with plant and animal life, chemistry and physics, biology and mechanics, astronomy and geology, but it is written by one man, and not as one would expect by a

group of specialists. In the changes that are sure to come, Geography itself may be found as part of a general science course.

How can we be prepared for such eventualities? Only by realising that our specialisation must be broad-based upon a firm foundation. We sometimes hear of cultural and useful subjects, as though there were a conflict between them. But Geography may be included in both. It leads to a place from which many paths begin—geology and astronomy, botany and zoology, meteorology and economics, are all laid under contribution. Any one of these paths, if followed up by the pupils who leave school, will provide a valuable recreation for leisure times. There is no narrowing of interests. The pupil is learning about the world in which he lives, and how man is adapting himself to his environment under all sorts of conditions in different parts of the globe. This at least ought to help him in the task which any individual has to face of adapting himself to the world in which he finds himself.

Further, Geography helps other subjects. The key to much of our history is found in Geography. Delve into the causes of the great wars of history, from the struggle of Rome and Carthage to the Great European War, and in nearly every case you find the reason was geographical, the struggle for a more favoured land where food could be obtained for overpopulated empires. Or, study again the great racial migrations that have taken place. Nearly everyone of them was in search of a more fertile area, a better climate or a more protected land. History and Geography must be taught together, if History is to be properly understood.

Natural Science again presents problems that only Geography can solve. Why has Australia a peculiar fauna to itself? A study of Geography is necessary to understand this. Even pressing economic problems of the present day have a great deal of light thrown upon them by a knowledge of Geography. Ceylon was a prosperous island not long ago ; and why did her cocoanut trade suddenly decline? No doubt 300 years ago in the once prosperous cities of Venice, declining trade was equally embarrassing. But in each case the answer was the same. Europe can buy from West Africa what used to come from Ceylon, and the distance is much shorter. The opening of the Cape Route to the East took away all the trade from the Mediterranean. Such developments are going on all the time; and the best text-book a geography teacher

can have is a good daily newspaper. Only so will you keep your class up-to-date, only so will the pupils learn how to relate what they learn in class with what actually happens in the world.

Geography is valuable in another way. Properly taught it makes for understanding of other peoples, for the breaking down of barriers, for international peace. We do not hear much of internationalism nowadays; no sensible man would even dare talk of nationalism, when all the world has seen the failure of every attempt at agreement; but communalism flourishes and the clock is put back. The Geography teacher has it within his power to cultivate sympathy with those who are different from ourselves, because our understanding of Geography will make the reasons for those differences clear and understandable, and with understanding will come co-operation.

Sanderson said that 9 out of 10 people think with their hands. Geography ought to give scope to such people. One map is a good substitute for many pages of writing; maps built in clay or cement, models of life in other lands, physical features, astronomical bodies, meteorological apparatus, etc., give scope for endless activities. Skill is necessary, and the attainment of skill is being recognized more and more as equally important with the attainment of knowledge. There is a very wide and very urgent need in Geography lessons for this kind of activity.

Finally, I would say this: that Geography is a science, and must be treated as such. A good deal of slipshod superficial work is being done in the sacred name of up-to-date Geography. Nice little stories about Chin Chin Chow of China are very well in their way. But they must be as correct as we can make them; and along with this human side of Geography must come the real scientific discipline. What is science after all ? It is only observation and recording, and then the classification of the facts recorded. The keeping of proper weather records and comparison of the local records with the general weather report or the atlas, is one way of cultivating the spirit of accuracy. The study of maps will help to teach the right way of searching for new facts and testing the facts gained. A boy, for instance, who has drawn a rainfall map or physical map of India ought to be able to construct a hypothetical rice map with pretty fair accuracy. In comparing his effort with the actual map he will learn a good deal,

Unfortunately we have come to think of science as physics and chemistry; but the boy who cannot tell a specific gravity from density can still be a good scientist. It is the attitude of mind that distinguishes the scientist, not the medium he works in. It is a love of truth, a patient observation of facts, a constant study of his records and a constant testing of his conclusions, that makes the scientist. Geography deals primarily with man, and the world in relation to man; therefore, I suppose, it is to be classed among the humanities; but the study must be carried out in the true scientific spirit, reaching out towards the exact sciences, and so giving an all-round development that will make the next generation better equipped than its father to meet the needs of life.

The Geography of the Past

By

Dr. B. Sahni.

Under the auspices of the Vizagapatam Athenaeum, Dr. Birbal Sahni of the Lucknow University, delivered an interesting lecture on the "Past Geography of the World." Sir C. V. Raman presided.

Sir C. V. Raman, in his introductory remarks, humorously observed that the Punjab was so much associated with a fierce, bold, stalwart people, with manly vigour, that if the public expected to find in Dr. Sahni, a typical Punjabee of the conventional type, they would be disappointed. Dr. Sahni was a greatly reputed Doctor of Sciences. Dr. Sahni was so full of expert suggestions on every subject concerning knowledge that Sir C. V. Raman wondered what Dr. Sahni did not know. Dr. Sahni came to Vizagapatam apparently for the first time and no sooner had he seen the place for a few hours, he made a splendid suggestion that the place would be excellent as a first class station of marine biological research.

ORIGIN OF THE CONTINENTS

Dr. Sahni said that he chose as the title for his lecture of the evening, "Reconstruction of the Geography of the Past", because it had a great fascination for him. It was a subject that was of immense interest to the geologist, the geographer, historian, biologist, physicist, chemist and every other "ist" as well as the philosopher. The philosophy of science was not the conventional philosophy with which the majority of them were familiar ; it did not allow unbounded, unbridled licence to the imagination, but was directly controlled by observed facts and experience.

Proceeding, Dr. Sahni said that if they looked at the map of the Atlantic Ocean they would find that the opposite sides of Africa and South America, if brought sufficiently close to each other, fitted together almost exactly as if forming one piece of land. A like similarity was to be found between the eastern coast of Africa

and the Island of Madagascar. He then explained that various hypotheses had been made regarding the similarity of the fauna and flora and the stratographical structure of land on both sides of the oceans where the sinuosities of coastline almost fitted into each other. According to one theory, the continents were like icebergs floating on a mass of lesser density, and that, at some remote past, what was one great mass of land consisting of Africa, Asia, Australia and Antarctica, covered over to a great extent by an enormous ice-sheet, had broken by rifts in the crust of the earth's surface and drifted away leaving the gap now occupied by the Indian Ocean. That India was once covered by ice was discovered in the early eighties of the last century by signs of glaciation found near Talcher about 200 miles north-west of Berhampore (Ganjam). In those far off days South India was said to have been in the same latitude as South Africa, and the eastern coastline of Africa and the western seaboard of India almost hugged each other. But by the process of 'continental drift', India had receded north-eastwards and in the same process the Himalayas were raised out of the bed of the sea by forcing up the strata in a series of movements. This drift of the continents, its extent and direction, had been recorded by observatories in various parts of the world by calculating the time of transit of the stars over particular spots.

THEORY OF LOST CONTINENTS

A different theory was that, while the continents had always occupied their present positions with the similarity of the fossils found and of the fauna and flora, there existed in those very remote periods land bridges connecting these great masses of land and that these bridges were now supposed to have gradually sunk into the sea-bed. According to this theory, two great masses of land that once existed in what were now called the Atlantic and Indian Oceans, i.e., Atlantis and Lemuria, had been lost and attempts were being made from time to time to discover these lost continents. Dr. Sahni stated that the great mass of evidence was in favour of the theory that the continents drifted away. The Nile Valley in Africa was supposed to be another great rift in the surface of the earth's crust which, in the distant future, would separate a big slice of north-east Africa by the inlet of the sea.

Sir C. V. Raman said, in his concluding remarks, that Dr. Sahni's description of the Poles wandering about, continents

moving up and down on a walk, and the prospect of Egypt some day going under the sea making two more continents of Africa and the Nile becoming a huge ocean, made his head reel with the stupendousness of the prospect. He insisted that it was the duty of a scientist to be meticulously correct in his calculations. The difference of a few thousands or millions of years in calculations on a speculative subject as the Geography of the Past did not matter very much. But a scientist must muster sufficient courage necessary to propound such profound matters.

An Outline Syllabus in Geography

For Elementary Schools.

Preliminary Stage:—(Standards II and III).

STANDARD II.

1. *World Geography:*—Children of far off lands (Pictures).
2. *Home Geography:*—The village or town.
3. *Practical Work:*—Visits to local bazar, the brook or river, tank, fields, public buildings, etc. Sketches and pictures. Cardinal points. Project: Model of the village.

STANDARD III.

1. *World Geography:*—Peoples of our own and other lands, e.g., the Bengalis, the Punjabis, the Eskimos, the Arabs, the Chinese, the Pygmies, the Swiss, etc.
2. *Home Geography:*—The Taluk or Home Region, Revision of the village: fields, and crops, water-supply, drainage, industries, trade, communications to headquarters and other important places from the village.
3. *Practical Work:*—Introduction to the globe. Picture-reading. Direction and distance. Scales and plans. Sketches and maps of the home area. Visits and excursions. Map project.

Junior Stage:—(Standards IV and V).

STANDARD IV.

1. *World Geography:*—Continents and oceans: imaginary voyages to different parts of the globe (with stories of some famous discoverers and explorers like Columbus, Vasco da Gama, Livingstone, Captain Cook, etc.). Life in the lands thus visited. The *round* globe.
2. *Home Geography:*—The District (descriptive and not logical study).

3. *Practical Work:*—Introduction to the world map. Clay-modelling of land forms in the district. Seasonal changes and human activities. Observation of simple weather phenomena. Day and night: rotation of the earth. Phases of the moon: *'thithis.'* (திதிகள்)

STANDARD V.

1. *World Geography:*—Continents and oceans: trans-continental routes from the great ports. Commodities of everyday use such as sugar, coffee, match-box, kerosine oil etc. and the lands from which they are obtained.
2. *Home Geography:*—A survey of the Presidency (including the adjoining Indian States:) Descriptive study of the different regions with imaginary journeys. Great mountains and rivers of India. Railway journeys outside the province to Calcutta, Bombay, Benares, Delhi, etc.
3. *Practical Work:*—Use of maps of the world, India and the Presidency. Observational study of weather phenomena. Position of the sun in the sky at differrent parts of the year: Introduction to the seasons: revolution of the earth: zones. Cultivation, trade and travel projects, involving detailed study of the district.

Senior Stage:—(Standards VI, VII and VIII).

STANDARD VI.

1. *World Geography:*—Australia and Africa: descriptive study of selected typical regions (with an outline survey).
2. *Home Geography:*—A survey of India (Junior course). Detailed study of the district, linking it with the home locality (village or town).
3. *Practical Work:*—Introduction to latitude and longitude. Beginnings of weather record. Excursions and projects correlated with district study. Varieties of district maps. Revision of the seasons.

STANDARD VII.

1. *World Geography:*—The Americas: descriptive study of selected typical regions,

2. *Home Geography:*—Detailed study of Peninsular India with greater emphasis on the economic side.
3. *Practical Work:*—Further work on latitude and longitude. Representation of heights: contour exercises. Continuation of weather record work. Representation of climatic data, curves and charts. Economic curves. Work of running water as field study.

TANDARD VIII.

1. *World Geography:*—Eurasia: descripitve study of selected typical regions. A general survey of the regions of the world.
2. *Home Geography:*—Detailed study of India (senior course).
3. *Practical Work:*—Advanced contour work. Map-making by chain, pacing etc. (projects). Ordnance survey map of the home region: its interpretation and use in excursions. The daily weather report and its interpretation. Climatic maps. Field study of weathering, formation of soils, rocks and minerals and changes in land forms. Economic maps and diagrams.

Geography Syllabus for a Secondary School

CLASS III.

I. HOME.

1. Excursion to a field and the story of a Mangalore farmer.
2. Excursion to a tile factory and the story of a tile factory worker.
3. Excursion to the coffee works and the story of a coffee worker.
4. Excursion to a weaving establishment and the story of a weaver.
5. Excursion to the seashore or fish market and the story of a fisher.

N.B.—The above are the chief occupations and industries of Mangalore.

II. REGIONAL (use the globe).

A. Stories of people in other lands—their life, food, clothing, homes and various means of travelling and transport.

1. On a rainy day or a visit to a woody place—the pygmy.
2. On a visit to a grassy plain—(*a*) the Red Indian; (*b*) the Khirghiz.
3. On a cold day—the Esquimaux.
4. On a visit to an arid place—the Arabs.
5. On a visit to a hill—the Swiss.
6. Picture of a Japanese home—the Japanese.
7. Picture of a British home—the English boy or girl.

N.B.—Large pictures can substitute if excursions are not possible. Excursions should be in the compound and near neighbourhood as far as possible. Excursions and pictures would be ideal.

B. Other practical work in connection with the above.

1. Clay modelling or drawing in crayon or chalk or paper silhouettes of the implements used.
2. Construction of their homes.
3. Dressing up dolls to represent different peoples.

III. PRACTICAL WORK.

1. Map to show where I sit.
2. Map to show how I go to my seat—(*a*) from entrance door; (*b*) from my teacher's desk.
2. Map to show the class garden.
4. Map to show how I go to the class garden from my class, and similar easy practical exercises. Actual measurements not necessary.

IV. OBSERVATIONAL WORK.

1. Watch the position of the sun, morning, noon and evening, four times a year in June, September, November and March. Draw a diagram.
2. Wind—strong wind, light wind—in what direction.
3. Temperature—hot and cold days—simple reasons.
4. Rainy days—effect of rain —the formation of rivers.
5. Weather chart showing sunny, cloudy and rainy days.

Books to be consulted:—(*a*) Children Far Away and Homes Far Away by Fairgrieve and Young; (*b*) Primary Human Geography by the above.

CLASS IV.

I.

1. Cardinal points.
2. World—the shape of the earth (from the globe) and elementary ideas of rotation.
3. Land and water on the globe.
4. Name and positions of the five continents and five oceans.

II.

1. The world to be divided as in the World by Elsa Stamp. Base the climatic regions on knowledge of Class III, on the tundras and on the Eskimo. Teach new regions by way of comparison and contrast. Story method may be used, but give importance to the stage and not the people.
2. Mangalore.

3. S. Kanara.
4. In traced outlines insert the regions of the world and als(important features of (2) and (3).

III. PRACTICAL WORK.

1. Map to show my class room and its surroundings withir 50 ft.
2. Map to show the garden and its surroundings within 50 ft
3. Map to show the playground and its surroundings withir 50 ft.
4. Map to show a field and its surroundings within 50 ft.

N.B.—No actual measurements are necessary.

IV. OBSERVATIONAL WORK.

1. Measurement of shadows on any mid-day in July, Septem ber, January and April.
2. Note the length of days on these same days and the dif ference in temperature, rain and vegetation.
3. How rain is formed—keep a rainfall chart of a month.
4. Weather chart.
5. Excursion on a rainy day to a streamlet or a runnel t(explain these terms:—source, watershed, banks, mouth estuary and alluvium.
6. Excursion to a neighbouring stream.
7. Excursion to a hill and explain gentle and steep slope kinds of vegetation and the reason for it.

CLASS V.

I. MADRAS PRESIDENCY (Regionally).

West coast region, east coast region, Deccan. Include in study relief, climate, rainfall, vegetation, occupation, products population, important towns and communications.

N.B.—Much detail to be avoided.

II. INDIA IN DETAIL.

To be divided as in India by Elsa Stamp, to serve as a basis to Forms I and II. In traced outlines insert importan features of India.

III. PRACTICAL WORK.

1. Map of a road about 150 ft. showing surroundings 50 ft. on either side.
2. Map showing the way from the gate to the class room and surroundings within 50 ft.
3. Map showing the way from the gate to the garden and surroundings within 50 ft.
4. Map showing an enclosed area of more than 500 sq. ft. with important details.

N.B.—Actual measurements are not necessary.

IV. OBSERVATIONAL WORK.

1. Direction of the wind for a week in July, September, January, and April—a diagram.
2. Establish connection between winds, rainfall and vegetation.
3. Path of the sun in the heavens noted by a shadow stick.
4. Very simple weather chart.
5. Excursion to a railway station and pier to see exports and imports.
6. Excursion to a bazaar to see buying and selling.
7. Excursion to a factory to get an idea of industries in cities.
8. Excursion to a thickly wooded place; to a waterfall; to extensive plains; to any plantations.

MIDDLE SCHOOL—FORM I.

I. GENERAL WORLD GEOGRAPHY (use the globe).

A. Shape of the earth—its rotation, axis, poles, equator, Greenwich line—Its continents and oceans—Its spheres, northern and southern, eastern and western—Comparative extent of land and water in each sphere.

B. Elementary ideas of latitude (angular distance) and longitude through plotting points and also time.

N.B.—Refer to Form I Syllabus on Practical Work according to the departmental syllabus, by Mr. N. Subrahmanyam, Teachers' College, Saidapet. (Published by the Madras Teachers' Guild).

II. PRACTICAL WORK.

1. Map work by measurement—plan of a class-room, school-house, garden, any enclosed space, etc.
2. Idea of contours—very simple contours. Isotherms—read from the map only.
3. Picture reading—Typical pictures of different regions.
4. Observational work—sunrise, sunset and sun's midday position every week or fortnight—midday shadows, hence vertical and slanting rays—wind directions, seasonal temperature and rainfall. Chart of any month and hourly temperature of any one day in each of the four seasons.
5. Excursions.

N.B.—Refer to above-mentioned book.

III. AMERICAS.

New world in general i.e. position, history before civilisation and now—structural regions—North America and South America compared—climate and vegetation—Canada—United States—Central America—West Indies—S. America.

AFRICA.

Position, size, coastline—relief, rivers and lakes—exploration—peoples and political divisions—climate and rainfall—Vegetation—North Africa—Suez Canal—Egypt—Sudan and Congo—South Africa.

AUSTRALIA.

World position—extent, build, coastline, drainage—climate, vegetation and animals—minerals—political divisions, chief towns and government.

NEW ZEALAND.

Position—climate—productions, minerals, industries—chief towns.

N.B.—Refer to same series as above; but Form III practical work which must be simplified for Form I. Let the matter

: more descriptive than detailed. Use the maps and Atlases and t much of your information from them.

FORM II.

. EURASIA.

A. Asia—position, extent, coastline—relief and drainage, —climate and vegetation—natural regions, human life, occupations and industries—trade and communications —population, races and religions—political divisions, chief towns, government—main industries and occupations.

B. Europe—relief and rivers—regional study.

1. Mediterranean countries.
2. North-western countries.
3. Central countries.
4. Continental area of Russia.

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1. Longitude and latitude—more advanced. Exercises to find out places of given latitudes and longitudes and vice versa. Easy problems in longitude and time.
2. Observations—comparison of midday shadow, midday altitude of the sun, time of sunrise and sunset, and length of day in school locality weekly or every fortnight.
3. Apparent movements of the sun at different seasons.
4. Trade winds—by a diagram and not much theory.
5. Rainfall—effect of the sea—mountains and winds—Exercises on the map of the world—Isobars.
6. Simple contours and sections.
7. Temperature and rainfall charts.

N.B.—Refer to above-mentioned series of Madras Form II.

FORM III.

INDIA IN DETAIL.

Book to be used "The Indian Empire" by L. C. French and udley Stamp or "India, Burma and Ceylon" by C. Morrison.

Some help in exercises may be got from the above-mentioned syllabus of Form I (Madras).

II. GENERAL.

The swing of the sun and its effects—winds and rainfall regions—heat belts and range of temperature—major natural regions—important world productions—trade routes.

III. PRACTICAL WORK.

1. Advanced contours and sections.
2. Simple economic graphs and diagrams of exports and imports, production, population.

FOR TEACHERS ONLY.

Books for the Middle School besides the above-mentioned:—

1. Progressive Studies in Geography by Sankey and Meerut (Longmans), three books.
2. Elementary Exercises in Map Work by Spary (Longmans).
3. Intermediate Exercises in Map Work by Spary (Longmans).
4. Senior Exercises in Map Work by Spary (Longmans).
5. Wheaton's Modern Geographical Exercises—I, II, III, IV, VI and VII—A. H. Wheaton & Co., Ltd., Educational Publishers, Exeter, England.
6. The World by Dudley Stamp.
7. The Pupil's Class Book of Geography by Lay—Europe, Asia, the Americas, Africa, British Dominions of Australia.
8. The Indian Empire by Dudley Stamp.
9. A Text-book of High School Geography by N. Subrahmanyam.

The Old Observatories at Delhi and Jaipur

By

Mrs. P. S. Sundara Raj, M.R.S.T.

The visitor to New Delhi, as he drives from the station to the Secretariat buildings, passes one of the most interesting relics of the past. This is the old observatory of the Maharajah Jai Singh II of Jaipur, an astronomer-King who established five observatories, at Delhi, Jaipur, Ujjain, Benares and Mathura. I have seen only the two at Delhi and Jaipur, and therefore my remarks will be confined to these two only. I ought also to add that my visits to these two were prompted by their geographical and historical interest, as I am in no sense an astronomer. I may therefore be excused if the astronomical details given by me are insufficient for any astronomically-minded reader. A few words about the remarkable man who founded these observatories will not be out of place. He was born in 1686, the year in which Newton's Principia was completed, and he succeeded to the throne of Amber in 1699, when he was 13. He died in 1743, two hundred years after Copernicus, and says the historian, "his wives, concubines and *science* expired with him on his funeral pyre". The Maharajah Jai Singh was a remarkable man. He ascended the throne a few years before the death of Aurangzeb, and his reign coincided with a period of anarchy and warfare, in most of which he was involved. In spite of this he distinguished himself as a statesman; built himself a new capital, established observatories at five of the principal cities, and inaugurated and himself carried out a scheme of genuine scientific research. His observatories have been aptly described as "monuments that irradiate a dark period of Indian History".

No visitor to Jaipur, or Jainagar, the city which Jai Singh founded to take the place of that eagle's nest on the mountain side, the fortress of Amber, can fail to be impressed with the wide straight streets that would be a credit to any modern town planning scheme. In Jai Singh's own reign, his new capital became a centre of learning. Jai Singh himself was particularly attracted by astronomical work, and according to his own accounts he made himself thoroughly acquainted with its principles and rules. He

collected a library and had certain works translated. He employed a regular staff of workers, and sent some of them to foreign countries to collect information. He invited people interested in astronomy to Jaipur. He was attached to no one school of thought, but studied Hindu, Muslim and European methods impartially. He first built the observatory at Delhi and made observations there for seven years before building the other four. His aim was to prepare a new star catalogue, and to correct the defective tables then in use.

It is hardly necessary now, nor indeed have I the requisite qualifications, to enlarge upon the condition of the astronomical knowledge at the time of Jai Singh, but a few words are necessary if we are to place this remarkable man in his proper setting. As you are well aware, Hindu Astronomy goes back to remote antiquity. The astronomy of the Vedas is of poetical rather than scientific value, but the earliest formal astronomical works do possess "the crude elements of a scientific astronomy". Soon after the beginning of the Christian era, however, the old traditional system was largely discarded, and Greek theories were imported and assimilated. The representative work which exhibits this system is the Sanga Siddhanta, of which the recension now in use was made probably about 1,000 A.D. Since then very little advance has been made, and this text is still accepted as authoritative by the orthodox. The instruments described in ancient Hindu texts are very few, and there is no trace of any ancient observatory.

The Muslim school of astronomy were to some extent the direct successors of the Greeks, and frankly acknowledged their debt. In the middle ages they were the foremost astronomers of their time, and far excelled both their Hindu and European contemporaries. They recognised the necessity for methodical observation. So far as we know the first series of observations with fairly accurate instruments was made between 813 and 833 A.D. The Cairo observatory was founded in the 10th century, another in Persia in 1074 and a great observatory at Maragha in N. W. Persia in 1259. Old instruments were improved and new ones designed, and until the 15th century careful observations were carried on throughout the Moslem world. Then with Ulugh Beg, the scientific study of astronomy in the Islamic world came to an end.

In Europe practically no advance was made after the death of Ptolemy for a thousand years. Then, just about the time of Jai Singh, a great awakening took place. Copernicus wrote in the beginning of the 16th century. Galileo was about a century before Jai Singh. Greenwich observatory was founded some 40 years before that at Delhi. Newton's Principia was written at the time of Jai Singh's birth. Hamstead's catalogue of Stars was first printed in 1688, Halley in 1705 predicted the return of the Comet named after him. The Delhi observatory was built in 1724. While the Hindus almost completely relied upon tradition, and even the later Greek school tended to neglect observation and worked only upon observations recorded by their predecessors, the Arabs and other Muslim astronomers laid great emphasis upon direct observations. They verified and corrected Ptolemy's elements, but it never occurred to them to re-examine the Greek theories. The invention of the telescope, however, gave a great impetus to research and with the death of the Ptolemic theory European astronomers were able to discard the methods of their predecessors, and they invented instruments of types altogether unimaginable by their Arabic teachers.

Jai Singh, as we have said, learnt from these schools of thought. The great library he collected is not now intact, but we know that he procured books from Europe, and it is safe to assume that he collected and studied all the available works on astronomy. Jai Singh's turn of mind was essentially practical. He realised the need for observation and measurement, and in his plans for building an observatory he had ready to hand the models of the Muslim astronomers. He decided that the metal instruments in use were subject to certain defects inherent in their construction. As we are told, "Finding the brass instruments did not come up to the ideas which he had formed of accuracy, because of the smallness of their size, the want of divisions into minutes, the shaking and wearing of their axes, the displacement of the centres of the circles, and the shifting of the planes of the instruments, he concluded that the reason why the determination of the ancients, such as Hipparchus and Ptolemy, proved inaccurate, must have been of this kind". In order to reduce such errors, he constructed his instruments of masonry and planned them on a gigantic scale. It is interesting to notice that the new European school also recognised the possibility of error, and made allowance for it, and this led to the invention of the micrometer and the

vernier scale, an exactly opposite line of development to that taken by Jai Singh. The old Muslim observatories had contained some large instruments, which no doubt served as a base for Jai Singh's new constructions. He, however, improved upon his models, and evolved new forms of his own. It is perhaps surprising that there is not more direct European influence to be seen, but two reasons may be advanced for this. He had probably settled the line of his own work before he became acquainted with the new developments in the West. It is supposed that his tables were completed somewhere about 1728, a few years after the building of the Delhi observatory. It was in 1728 or 1729 that he sent "several skilful persons" to Europe, and in 1734 he was visited by Father Boudier and his companions. The fact that Galileo died in prison in 1642—his books were actually not removed from the index until 1835—may also have had something to do with Jai Singh's neglect of the rapid and wonderful development that was going on in the West. He may have found it difficult to assess the value of these brilliant discoveries in the light of the persecution by authority.

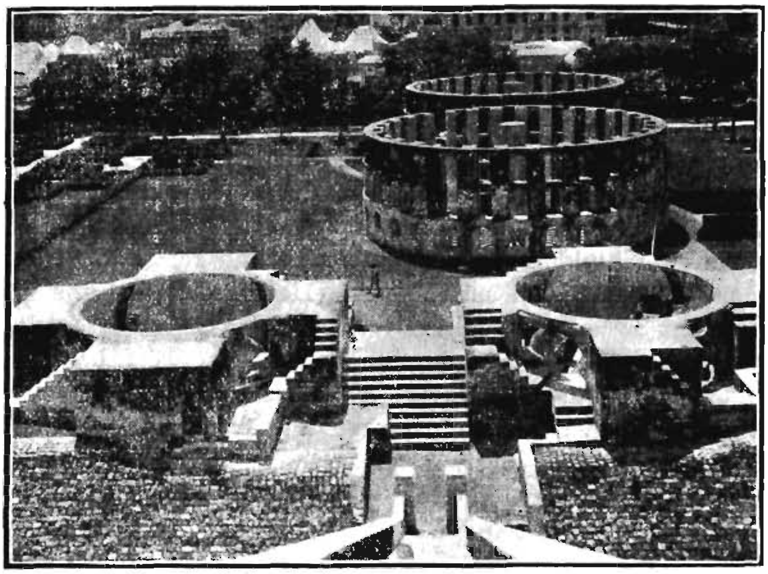


Fig. 9. General view of the Observatory, Delhi

Let us now turn to the actual observatories. That at Delhi has been restored by the present Maharajah of Jaipur, and the buildings given an attractive garden setting. The one at Jaipur

is situated within the palace precincts, and has therefore suffered less from the ravages of war and the vicissitudes of time. Both contain similar instruments, with some differences. That at Jaipur is somewhat larger, and still retains a number of metal instruments. There is some confusion about the date of the building of Delhi observatory. Sayed Ahmed Khan gives 1724-25 as the year in which Jai Singh carried out the "mighty task" set him by the Emperor Muhammad Shah, and "to accomplish the exalted command he had received, he bound the girdle of resolution about the loins of his soul and constructed (at Delhi) several of the instruments of an observatory, such as had been erected at Samarquand". The first object to strike the attention is the great Samrat

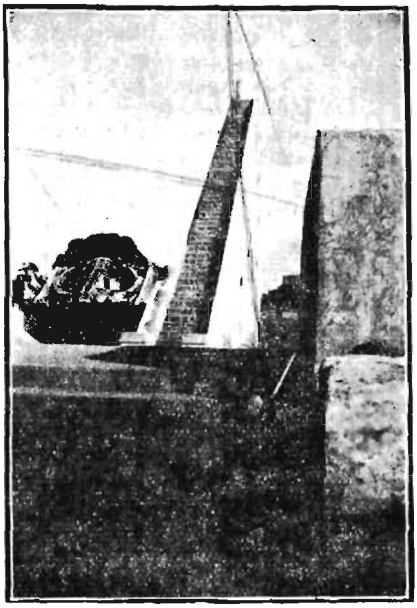


Fig. 10. Samrat Yantra, Delhi

Yantra, 68 ft. high (Fig. 10). The Jaipur one is even higher, 90 ft. high and 147 ft. long. It will be readily seen that Jai Singh's reasoning with regard to the construction of his instruments was only partially correct. It is true that his masonry was not subject to the wear and tear of brass, but on the other hand by their very size these erections prevented any improvement or modification. The Samrat Yantra is the most important of all the instruments. *It is really "an equinoctical dial, consisting of a triangular gnomon* with the hypotenuse parallel to the earth's axis, and on either side

of the gnomon is a quadrant of a circle parallel to the plane of the equator. (Only the gnomon appears in the picture.) It is in principle one of the simplest 'equal hour' sun dials". Each edge of the quadrants is graduated in hours and minutes, as well as in degrees. The shadow on the edge of the gnomon on the quadrants gives the local time. The dials give apparent solar time, which varies from day to day for several reasons. The two chief of these are, first the eccentricity of the earth's orbit, which gives a more rapid angular motion in winter, when it is nearer the sun, and its slower motion in summer; secondly, the obliquity of the ecliptic. Clock time therefore will not agree for very long with solar time as given by the dial.

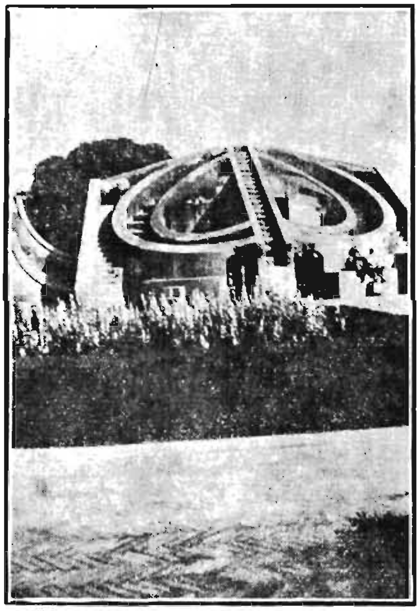


Fig. 11. Misra Yantra, Delhi

The Samrat Yantra is built into a quadrangular excavation 15 feet deep and nearly 125 feet square.

On the top of the gnomon is a circular pillar. This was probably originally used for rough azimuth observations, but it is now surmounted by a small dial of the European type, probably added in 1920.

In the front right hand side of the picture No. 10 appears part of a chamber containing the Shashthamsa Yantra, which is built

into the mass of masonry supporting the east quadrant. The Shashthamsa Yantra is a large graduated arc 60 degrees in length built in the plane of the meridian. The sun as it passes the meridian, shines through a small orifice on to the arc, and indicates its meridian altitude. The chamber is now closed.

To the north-west of the Samrat Yantra and about 140 ft. away, is the Misra Yantra, or "mixed instrument" (Fig 11). It is so named because it combines in itself four separate instruments. (1) In the centre is the Nujatchakra. This is a gnomon with two graduated semicircles on either side. These semicircles lie in planes inclined to the plane of the Delhi meridian at angles of approximately 77 degrees and 68½ degrees E. and W. These semicircles may be said to correspond to meridians at places whose longitudes differ from Delhi by these angles, and tradition names Greenwich and Zurich, Norkey, a village in Japan where there is an observatory, and Serichew, a town in the Pie Islands in the Pacific Ocean, E. of Russia as these places. On either side of the

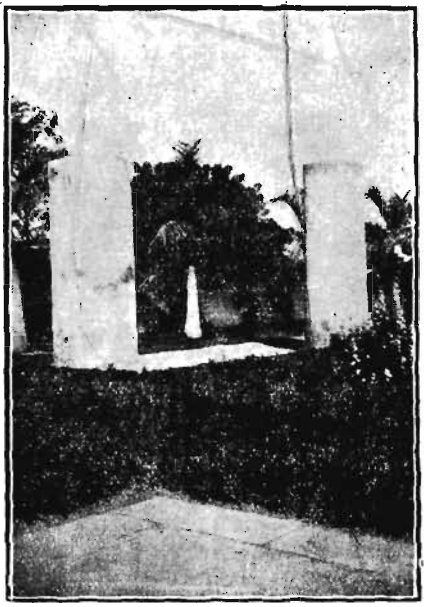


Fig. 12. Pillars, Delhi

Nujatchakra, and joined to it, is half of an equinoctial dial, a smaller edition of the greater Samrat Yantra. The west side contains a second quadrant, the face of which is horizontal instead of being parallel to the axis.

In the east wall of the building is a graduated semicircle used for obtaining meridian altitudes. The north wall is inclined at an angle of 5 degrees and is marked with a large graduated circle. This is the "circle of the sign of Cancer". When it enters Cancer, the sun shines over the North wall for a short period and the shadow of the centre pin falls on the graduated circle. It is possible that the Misra Yantra was added by Jai Singh's son, who, we are told, inherited his father's love of science. To the South-West of the Misra Yantra are two pillars 17 ft. apart (Fig. 12). The line joining their centres points 35° E. of north. These are mentioned in none of the early accounts of the observatory. The custodian explained them to me as marking the shadow on the longest day, or something of that sort, but it is most likely that they were used to support some metal instruments such as those still to be seen at Jaipur.

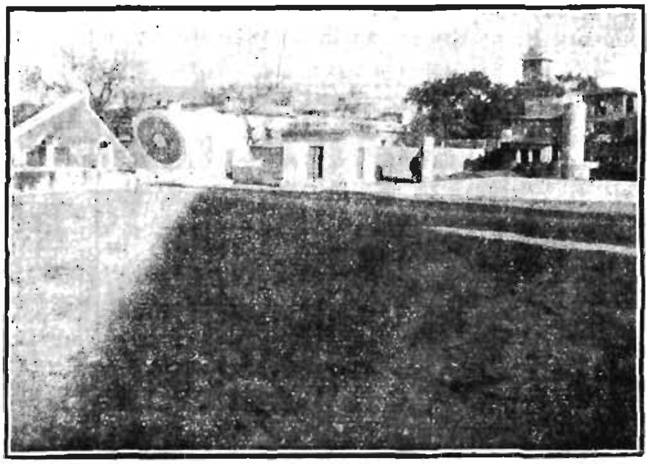


Fig. 13. Jaipur

In Jaipur also two somewhat similar pillars may be seen (Fig. 13). It is not known what they were used for, unless for supporting metal instruments now lost. The shadow from the great Samrat Yantra can be clearly seen. In this the gnomon is 90 ft. high. It is graduated to read to seconds, but in practice this is impossible, owing to the size of the penumbra. Part of the gnomon of the smaller Samrat Yantra appears. Jaipur possesses two of these instruments. As in Delhi, the Shashtamsa Yantra, that is the meridian circle, is built into a dark chamber in the mass of masonry supporting the quadrants of the huge Samrat Yantra. Jaipur has two such chambers.

Close to the smaller Samrat Yantra can be seen Narivalaya Yantra or circular dial. It is a masonry cylinder some 10 feet in diameter. This marks the time of day, and also the passage of the sun across the equator. Below it, clearly shown, is the Dakshina-*vrithi Yantra* (Fig. 13), or *meridian circle*, which is built into the supporting masonry work. This is a mural quadrant. On the East face are two quadrants of 20 ft. radius, and on the West face a semi-circle of 19 ft. 10 inches radius. It corresponds to the modern transit circle. It was used for taking meridian altitudes.

The next picture shows the Rasivalaya at Jaipur (Fig. 14). This instrument consists of 12 dials, one for each sign of the Zodiac, built on a common platform. You can see that they are exactly of the

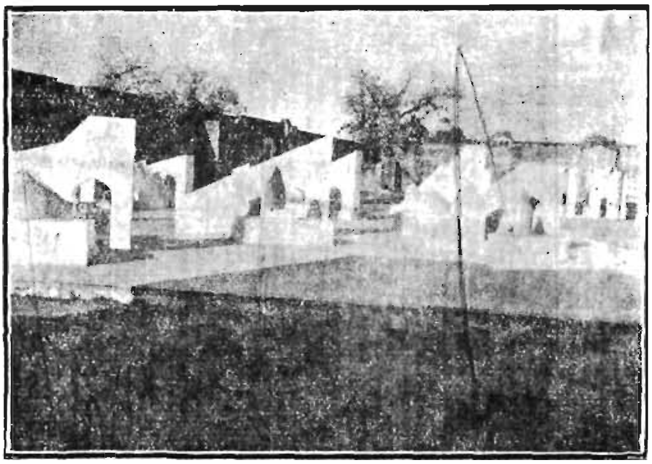


Fig. 14. Rasivalaya, Jaipur

same type as the big Samrat Yantra, but "the quadrants lie, not in the plane of the equator but in the plane of the ecliptic when the particular sign is on the horizon, and the edge of the gnomon then points to the pole of the ecliptic". Four instruments have quadrants of 5 feet 6 inches radius, while the other eight have 4 feet 1½ inches. These instruments will indicate at the proper moment the sun's latitude, and with appropriate graduations, the longitude. The early lists do not mention the Rasivalaya.

Just beyond can be seen the Chakra Yantra, which appears plainly in the next picture (Fig. 15). There are two at Jaipur. Each is a metal ring of 6 feet in diameter, so fixed as to revolve

about an axis parallel to the earth's axis. At the southern end of the axis of the big circle is a small fixed graduated circle.

Both Jaipur and Delhi contain other interesting instruments which there is not time to describe in detail now. Some of them are very ingenious in design, and must be to a large extent attributed to Jai Singh's own personal enthusiasm and ingenuity. He claims himself to have devised the huge dials, Samrat Yantra, as well as certain other instruments. Without illustrations I do not think there will be much value in a description of instruments

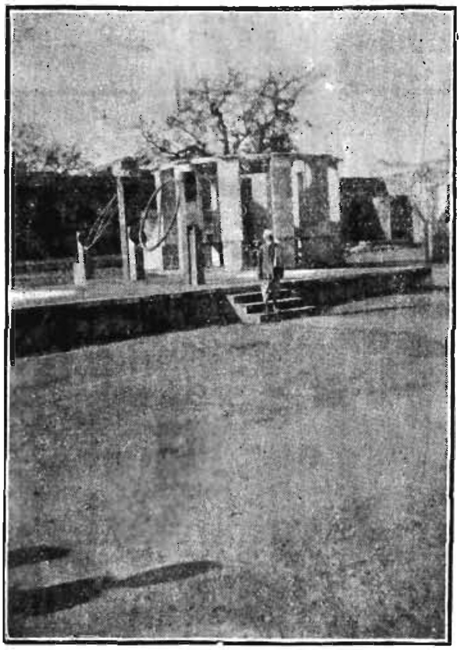


Fig. 15. Chakra Yantra, Jaipur

so foreign to our modern ideas as these are now. I have given this short description only in the hope that some who may be travelling northwards may be encouraged to spend a little time in examining these memorials to a lover of science of other times. Although the observatories are not now used for practical purposes, a better set of instruments could scarcely be devised for teaching the elements of astronomy, and it will be a great pity if the schools in the neighbourhood do not take full advantage of them for teaching Geography.

Report of the Refresher Course in Geography held at Trichy in May 1933

The Working Council of the Madras Geographical Association presents the following Report of the Refresher Course in Geography held at Trichy in May 1933:—

On the invitation of the Committee of the XXVth Provincial Educational Conference, the Summer Course in Geography was conducted at Trichy from the 1st to the 13th May, 1933, at the National College and at the request of the same Committee the fee for the Course was reduced from Rs. 15 to Rs. 10, the period being also at the same time reduced to two weeks.

65 teachers, including 18 ladies, attended the Course (Appendix I).

At 10 a.m. on Monday the 1st May 1933, Mr. K. V. Subba Aiyar, M.A., L.T., Retired District Educational Officer, Trichinopoly, opened the Refresher Course at the Saraswathi Hall, National College (Appendix II), after which the classes were conducted as per time-table shown in Appendix III.

The Secretary of the Association who was in charge of the general organisation and conduct of the Course, did Climatology and the Pedagogy of Geography; Mr. S. Balakrishna Aiyar did Quantitative Methods; Mr. George Kuriyan did Mathematical Geography and Projections; Mr. B. M. Tirunarayanan did Map-work; Mr. G. Narayanaswami Aiyar Land Forms; and Mr. L. S. Natesan did Surveying in the St. Joseph's College and the National College compounds.

On the last two days, two shows of Geographical Films were given which were highly valued and appreciated (appendix IV).

As part of the Course, Excursions were arranged to the Rock Fort, Golden Rock, Upper Anicut and Gunasilam and Grand Anicut.

The Refresher Course came to a close on the evening of 13—5—1933 with formal thanksgiving, etc. (Appendix V).

Receipts and Payments are shown in Appendix VI.

As in the previous Courses, the Teachers who attended the classes went through every portion of the work earnestly and diligently, though the Course was generally felt to be a crowded one owing to the shortness of time. Printed certificates were issued in which special record was made of good work done by the Teachers.

(By order)

N. SUBRAHMANYAM,
Secretary.

Gopalapuram, Cathedral Post,
Madras, 15th July 1933.

APPENDIX I.

List of Teachers who attended the Refresher Course in Geography, in May 1933.

	Name.	School.
1.	Sister Aloysia.	Holy Cross College, Trichy.
2.	V. Aswathanarayana Aiyar.	E. R. High School, Teppakulam, Trichy.
3.	K. Balakrishnan.	Nil — On his own account.
4.	M. Balasubramanyan.	Nil — On his own account.
5.	Sister Mary Canice.	Apostolic Carmel School, Mangalore.
6.	K. Chakrapani Aiyar.	R. C. Bodg. & Training Institution, Trichy.
7.	M. Chandramouleswaran.	Nil — On his own account.
8.	V. Chandrasekharan.	Nil — On his own account.
9.	Paul Chellapah.	Training School, Palamcottah.
10.	Suguna Chinnappa.	Christian Girls' High School, Tanjore.
11.	Sister M. Clarissa.	Apostolic Carmel School, Mangalore.
12.	Sister Mary Claudia.	St. Ann's Model School, Mangalore.
13.	Miss Rita C. Desouza.	Sacred Heart High School for Girls Tellicherry.
14.	Miss F. Dinker.	Govt. Trg. School for Mahomedan Women, Guntur.
15.	P. V. Duraiswamy Aiyar.	Bd. Hr. Ele. School, Kolakkudi.
16.	Sister Eugenie.	St. Joseph's European High School, Trichy.
17.	Sister Febronia.	Holy Cross College, Trichy.
18.	Sister Mary Gabrielle.	St. Ann's Sec. Trg. and Model School Mangalore.
19.	Sister M. Gertrude, A.C.	St. Ann's Convent, Mangalore.
20.	V. Gnanasiromany.	V. M. School for Girls, Neyyoor.
21.	M. Gopala Ayyangar.	Pachaiyyapa's H. S. Chidambaram.
22.	T. S. Gopala Ayyangar.	Sri Satyamoorthy Secondary School Tirumayam.
23.	K. Guruswamy.	Ponniah's High School, Trichy.
24.	Godavarty Hanumantha Rao.	Town High School, Guntur.
25.	K. Hariharan.	Nil — On his own account.
26.	Samuel Harris.	Duthie's Girls' English High School Nagercoil.
27.	C. T. Jacob.	B. E. M. P. High School, Tellicherry.
28.	Jebagnanamani Ignatius.	Girls' Christian High School, Tanjore.

29. A. R. Krishnamoorthy.	Bd. Hr. Ele. School, Kolakkudi.
30. S. Krishnamoorthy Aiyar.	St. Xavier's College, Palamcottah.
31. Sister Mary Leocrice.	St. Agnes' Convent, Bendore, Mangalore.
32. Sister Melanie.	Holy Cross College, Trichy.
33. S. P. Nataraja Sastrigal.	S. I. Ry. School, Golden Rock.
34. K. N. Pasupathi Aiyar.	Municipal High School, Kurnool.
35. M. Raju Mudaliar.	Board High School, Cheyyar.
36. M. N. Ramachandran.	Board High School, Lalgudi.
37. N. V. Ramachandran.	Nil On his own account.
38. S. Ramakrishna Avadhani.	National College H. C., Trichy.
39. A. Ramakrishna Rao.	Town High School, Guntur.
40. T. S. Ramasubramanian.	Ranee's Free Girls' High School, Pudukottah.
41. A. S. Ramaswami Ayyangar.	The High School, Srirangam.
42. B. Ranga Rao.	Board Higher Grade Ele. School, Thathiengarpet, Musiri.
43. K. N. Rangaswami Aiyar.	The High School, Srirangam.
44. Sister Mary Ruth.	St. Ann's Secondary Training and Model School, Mangalore.
45. A. Sadagopachari.	The High School, Srirangam.
46. R. Sadasiva Aiyar.	Reddiar High School, Rangoon.
47. K. S. Sadasivan.	Board High School, Uttiramerur.
48. John Henry Samuel.	Board High School, Lalgudi.
49. K. Sanjivi Sarma.	Board High School, Polur.
50. A. Sankaran.	St. Xavier's College, Palamcottah.
51. K. G. Sankaranarayana Aiyar.	Board High School, Usilampatti.
52. P. A. Shanmugasundaram.	Board Sec. School, Udayarpalayam.
53. T. K. Srinivasa Ayyangar.	Nil On his own account.
54. R. Srinivasa Pillai.	Board Middle School, Udayarpalayam.
55. S. Srinivasa Raghava Ayyangar.	Mahajana High School, Erode.
56. M. R. Sripathi Rao.	R. B. A. N. M. High School, Bangalore.
57. G. Subramania Aiyar.	Aided Higher Ele. School, Nagamangalam, Ariyalur.
58. G. S. Subramaniyam.	Nil On his own account.
59. P. R. Subramania Aiyar.	Board High School, Kottayi.
60. M. B. Sundaresa Aiyar.	S. M. S. Vidyasala, Karaikudi.
61. S. Swaminathan.	E. R. High School, Trichy.
62. V. K. Swaminathan.	Board Elementary School, Ponneri.
63. Sister Therissa.	Holy Cross College, Trichy.
64. S. Venkatraman.	Board High School, Lalgudi.
65. M. Viswanathan.	St. Paul's High School, Phirangipuram.

APPENDIX II.

Opening of the Summer School of Geography.

The Summer School of Geography organised in connection with the Provincial Educational Conference was declared open at 10 A.M. on 1—5—1933 in the National College by Mr. K. V. Subba Aiyar, M.A., L.T., Retired District Educational Officer, Trichinopoly, in the presence of a large gathering of teachers and educationists from the different districts of the Presidency.

Mr. M. Krishnamurthi Aiyar, Secretary of the Summer School Course, welcomed the teachers in a short speech.

Mr. N. Subrahmania Aiyar, Secretary of the Madras Geographical Association, made a statement regarding the genesis and the continuance of the Summer Schools and the Refresher Courses. He said that the first Summer School was started in 1926 even before the S. S. L. C. Scheme was ushered in. The idea was not to train teachers who did not know anything of Geography and make them experts in a fortnight, but to take in those who have already been teaching the subject and were enthusiastic in their own way, but were not quite modern and give them training in the modern methods, especially in practical work. They had 30 students in the first year and there was so much demand that they had to take in 60 in the second year. They had the same number in the two previous Summer Schools so that they had trained 210 teachers in that way. In the map of knowledge, the speaker went on to say, Geography had always a place, because it was the one subject that made the child know its own place in Nature and in Society. There was no other subject that was so immediately necessary as this science of human environment. The excuse of the Madras Geographical Association in running these courses was that there was a need; and the fact was proved by the numerous applications received from teachers who were willing to pay Rs. 10 for 14 days besides paying their own fares incurring boarding and lodging expenses. Though the period of training had been reduced to a fortnight, he hoped that they would take the fullest advantage of the opportunity and utilise the period successfully. He then requested Mr. Subba Aiyar to declare the school open.

MR. K. V. SUBBA AIYAR'S SPEECH

In declaring the Summer School open, Mr. K. V. Subba Aiyar said that ever since its inception he had been watching very closely the progress and development of the Madras Geographical Association and had also been a careful reader of the Journal of the Association which, among other things, had undertaken a critical, searching, geographical study of the districts of the Presidency and quite a complete study of the districts of Malabar and Coimbatore, Madura and Ramnad had been given therein. As an ardent student of ancient history and archaeology, the speaker found from a study of the journal new information altogether from all points of view. For the first time perhaps in the history of geography it had been raised to a high pedestal and it had been made the queen of sciences, exacting homage, allegiance and service of other sciences.

Almost every science had been brought into service to give complete information on the subject of Geography of the above districts and he was so pleased to see Geography elevated to its real position as he considered it to be the foremost and first of the general knowledge subjects. He considered it was useless to waste money on University Education if it would not prepare young men for life. They had to look to Secondary Education for the equipment of life, but the Secondary School Scheme has been most unfortunate. It has undergone many changes almost from year to year. The poor students were experimented upon, there was nothing final, nothing conclusive so far as the School Final Scheme was concerned. Even at the present time, it was in the melting pot. In his own opinion, whatever might be the subject introduced in the School Final Scheme, Geography and Manual Training must occupy the foremost place.

Mr. S. Ramakrishna Avadhani, M.A., L.T., Secretary of the Geographical Conference, proposed a vote of thanks to the distinguished guests after which the course was begun by Mr. N. Subrahmania Aiyar.

APPENDIX III.

THE MADRAS GEOGRAPHICAL ASSOCIATION—TIME-TABLE.

Days.	7 to 9 A.M.	10 to 11 A.M.	11 A.M. to 1 P.M.	2 to 4 P.M.	4-15 to 6-15 P.M.
1st Mon. 2nd Tue. 3rd Wed. 4th Thu. 5th Fri. 6th Sat.	Surveying (Batch I)	Lectures on Pedagogy of Geography	Land forms (Batch I) Map Work (Batch II)	Map Work (Batch I) Land Forms (Batch II)	Surveying (Batch II)
8th Mon. 9th Tue. 10th Wed. 11th Thu. 12th Fri. 13th Sat.			Quantitative Methods (Batch I) Climatology (Batch II)	Climatology (Batch I) Quantitative Methods (Batch II)	

APPENDIX IV.

List of Films shown at the Refresher Course

1. The Earth. 2. Mount Everest. 3. Ocean Liners. 4. The Panama Canal. 5. London to Paris by air. 6. Animal Friends (London Zoo). 7. Sericulture. 8. Cotton Cultivation. 9. Comics: Pawn Shop, Iron Mule and Easy Street.

APPENDIX V.

Thanksgiving function: 13-5-'33, 5 p.m., Saraswathi Hall, Summer School of Geographical Refresher Course, Trichinopoly National Collgee.

Mr. K. N. Pasupathi Aiyar, B.A., L.T., of Kurnool, on behalf of the teachers proposed a vote of thanks and spoke as follows: —

Ladies and Gentlemen,

With to-day ends our Summer School of Geography and we have before us a very long vacation! Born only 13 days ago, it may appear, at first sight, surprising that it should come to a close so soon! But I am sure that all my fellow-teachers that attended the course will agree with me when I say that, judging from the volume of work done, it looks as though we had been at work for a full term!

Well, on this occasion, when we have the privilege of meeting all our lecturers, and on this last day of our Summer School, I wish to say, on behalf of you all, teachers who have come from various parts of the Presidency to attend the course, and on behalf of myself coming from far off Kurnool, a word of thanks and, if I may say so, a word of appreciation for the efficient and thorough manner in which the Geographical course has been organised and conducted by our able Professor, Mr. N. Subrahmanyam, M.A., L.T. He has secured, for our benefit and enlightment, the kindly offices and valuable services of several learned lecturers—all experts and specialists in the various branches of the subject of Geography—and, thanks to him, it has been our rare privilege and opportunity to hear them talk on the subject.

We have had a busy and useful time during these two weeks. And within the short compass of barely a fortnight, we have been equipped with information on the various aspects of the theoretical and practical side of the subject. We have learnt not merely the contents of geography in all its ramifications, but the proper methods of handling it in the class-room. We have been taught the various kinds of practical work to be done in the geography classes to enable the pupils to visualise properly the chief facts and principles of the subject. We have also had a practical course of Field and Compass Survey, a knowledge of which is helpful to map-making.

Friends, it is no exaggeration to say that the work done during the fortnight has considerably broadened our mental horizon in relation to the subject of Geography ; and, this breadth of view gained here, is, I dare say, bound to improve our lines of teaching the subject to boys and girls when we go back to our schools. That is the general impression left on me by the Geographical Refresher Course we have attended, and I have no doubt, you all feel alike on the matter.

Speaking personally, I am thankful to all our learned lecturers —particularly to Mr. N. Subrahmanyam—for having aroused in me a new interest in Geography and for having clarified many of my vague notions on the subject. I earnestly trust that this new interest will lead me on to a deeper study of the subject and a right handling of it in the class-room.

Our Professor, Mr. N. Subrahmanyam, was pleased to take us round on excusions to a number of interesting places and enlighten us by his valuable explanations and talks on every object observed—all from the angle of Geography. He has such a vast enthusiasm for the subject that he is never tired of talking on it ; and if only we teachers teaching it in schools were infected with his enthusiasm, I am confident that Geography in schools will not be the drudgery that it still continues to be in most places ; but shall become an interesting study to children and yield much better results than at present.

So, Ladies and Gentlemen, I propose a very hearty vote of thanks to Prof. N. Subrahmanyam, M.A., L.T., for all that he has done for our good these two weeks, and for his highly instructive lectures on the pedagogical aspects of Geography. I also

heartily thank Prof. George Kuriyan of the Madras University for his learned lectures on such difficult themes as Cartography, Oceanography, and Mathematical Geography. I wish to tender my thanks also to Prof. S. Balakrishna Iyer, M.A., L.T., for quantitative methods. Our thanks are due to Mr. B. M. Thiru-narayanan, B.A., (Hons.) (London)) for his interesting talks and practical help on Map-study; to Mr. G. Narayanaswamy Iyer, M.A., L.T., for the fund of information provided by him on Land-forms and Geological aspects of Study; to Mr. L. N. Natesa Iyer for his lectures and field-work in connection with Survey; and to Mr. Krishna Iyer, M.A., (Dip. in Geo.), for the valuable tutorial work done by him.

Lastly, I wish to express my heartfelt gratitude to Prof. V. Saranathan, M.A., Principal of the National College, and Mr. S. T. Ramanuja Iyengar, B.A., L.T., General Secretary of the 25th Provincial Educational Conference, for the excellent arrangements made by them for our stay in the city during the Geographical Refresher Course and for making our short sojourn here happy and enjoyable.

One word more, and I close. I wish to touch upon the human aspect of the Geography Refresher Course we have been attending. To me, the course has been not merely a series of monotonous graph-work and map-work, but an opportunity to meet so many fellow-workers in the field of teaching, to come in contact with one another, and exchange and compare notes on the many things connected with our every-day school-work, as well as the service conditions that obtain in the several parts of the Presidency. Moreover, during these two weeks, I felt as though I were rehearsing my old happy college days, living a care-free life,—save the only care of studying Geography—and enjoying the company of learned lecturers and brother teachers.

I shall treasure the memory of this short period of student-life in the Summer School of Geography at Trichinopoly as a precious time in my career and I hope I shall, in future years, look back to this eventful fortnight with a reminiscent feeling of warmth and joy.

With these words, Ladies and Gentlemen, I request you all to join with me in proposing a hearty vote of thanks to one and all the gentlemen who have contributed to the success of our Geographical Refresher Course.

APPENDIX VI.

THE MADRAS GEOGRAPHICAL ASSOCIATION, MADRAS.

The Refresher Course in Geography—Session, May 1933.

Statement of Receipts and Disbursements for the above Session.

Receipts.	Rs. A. P.	Disbursements.	Rs. A. P.
Fees ..	650 0 0	Stationery ..	83 11 0
		Postage ..	20 0 0
		Freight, Cartage, Cooly and Conveyance ..	27 4 0
		Remuneration to Lecturers and other Demonstrators ..	480 0 0
		Water Supply & Sundries ..	2 0 0
		Services of Clerk & Peon ..	9 0 0
		Purchase of Equipment ..	6 12 0
		Excursions ..	4 3 6
		Exhibition of Films ..	10 0 0
		Amount transferred to Association account ..	7 1 6
Total ..	650 0 0	Total ..	650 0 0

Note.—Equipment purchased is taken over by the Association at the end of the Session.

C. M. GOPAL,
Treasurer.

N. SUBRAHMANYAM,
Secretary.

Checked and found correct in accordance with the accounts.

G. L. NARASIMHAM,
Auditor.

14—7—1933.

News and Notes

This number of the Journal contains the Proceedings of the Geographical Conference including the Presidential Address of Prof. K. A. Nilakanta Sastri. The papers read at the Conference have been held over for publication in the next number, as some of them have not yet been received.

* * *

The Refresher Course at Trichinopoly in May 1933 was conducted at the National College; and the Report about the same will be found elsewhere. Sixty teachers underwent the course, which was gone through with much enthusiasm and earnestness.

* * *

The Tiruvallur Regional Survey Committee of the Working Council of the Association has set to work about their business in right earnest. Mr. V. Krishnan, M.A., Dip. Econ., Dip. Geo., has been appointed to collect data and work out some of the maps, etc., on the spot under the general direction of the Committee, which has been meeting every fortnight.

A local visit was paid by the members of the Committee to the village of Thannirkulam in the Rural Reconstruction area. The response to the appeal for the Research Fund of the Association has so far not been encouraging. We repeat the appeal and hope that members will contribute their mite for the work undertaken which involves some considerable expense.

The pre-occupation with this all absorbing work has prevented the usual monthly meetings being held regularly.

* * *

Two suggestive Syllabuses in Geography—one for the Elementary School and the other for the Secondary School—are published in this issue. The latter is in use in some of the schools of the West Coast. The Departmental Syllabus for the first three forms is not quite satisfactory; and it is therefore necessary that Teachers' Guilds should try to prepare model syllabuses that are

modern, intelligent and workable; and try them in some schools. It is all the more so in view of the fact that the subject is likely to be removed from the A group of the S. S. L. C. course according to the present proposals of the S. S. L. C. Board. Middle School Geography had better be made more interesting and useful, though it is not possible to give the pupils below 14 years that rational understanding of the subject which they can have only in the High School.

* * *

It does not seem to be a commendable thing to drop altogether from the compulsory group of the High School course cultural subjects like Elementary Science, History and Geography on the plea of lightening the syllabus or of introducing variety in the course. The same consummation can be reached with less chance of lowering the quality of education by getting the syllabuses revised with a view to lightening them and by an easy compromise of having two or three alternative courses in the group under Elementary Science, History and Geography, so that instead of all boys being compelled to go through the whole of the syllabus in these subjects, they may be made to study some chosen part of each of them.

* * *

We welcome the new move of the S. S. L. C. Board in resolving to introduce shorter and more direct questions for S. S. L. C. Examination as being more objective and reliable and issuing specimen papers for the guidance of teachers. We doubt, however, if the modern tests are the right thing in Geography in an external examination in which more than 20,000 candidates are examined, and feel that the short essay type of questions would be preferable in Geography as in the other subjects. It will be difficult to foresee what effect the new mode of examination will have on the percentage of passes, as answers will have to be *more accurate* under the new order.

* * *

The teaching of Geography in the Intermediate course is still confined to Queen Mary's College alone; and it is hoped that since qualified teachers of the subject are now available, other colleges will provide for its teaching at that stage.

We have much pleasure in congratulating Miss K. S. Ranga Rao who has qualified herself in Geography with great credit and welcoming her back. It is hoped that the authorities will utilise her services in the best manner by opening Geography in the B.A. Degree course in Queen Mary's College.

* * * *

In the Andhra University, Geography finds a place in the University Calendar alone, no college having as yet introduced it. In the Oosmania, Mysore and Annamalai Universities, even that theoretical recognition of this important branch of knowledge has not yet been vouchsafed. It will be interesting to know when these younger Universities are likely to come into line with Universities abroad in this respect.

* * * *

The teaching of Geography is said to be at a low ebb in Travancore and schools seem to be improperly equipped for the proper handling of the subject. The Teachers' College at Trivandrum has not provided for the training of Geography teachers and the Arts College has not introduced the subject in the Intermediate stage. Now that a thorough reorganisation of the educational system of the State has been entrusted to an earnest, able and sympathetic officer like Mr. R. M. Statham we trust that important subject will be accorded its proper place in the school and the college and steps will be taken to improve the quality of teaching it at the various stages.

* * * *

It is proposed to arrange for an excursion through Mysore during the ensuing Michaelmas Holidays, the places intended to be visited being Kolar, Bangalore, Gersoppa, Bhadravati, Mysore, Kannambadi and Sivasamudram. The approximate cost from and to Madras will be about Rs. 40-50.

The party will start on the 20th instant and be back in Madras on the 1st October 1933. Members wishing to join the party will write to the Secretary accompanied by a remittance of Rs. 4. Programme is given on page 132 of the Journal.

Reviews

Philips' Informative Geographies: Book I—The Physical Basis of Geography by F. M. Miller (George Philip & Son, London), Price 1sh. 2d.

This is a neat little volume on Physical Geography for pupils at the High School stage. The book is intended not merely to be mastered and laid aside, but, in the words of Prof. E. G. R. Taylor who has written the foreword for it, "constantly referred to, and more fully understood as a widening regional knowledge allows of more complete illustration of general principles."

Starting with an account of the relations between *the Earth and the Sun* and the results flowing therefrom and a chapter on *Maps and Map-drawing,* the pupil is taken through a course of study of the physical forms and physical laws which govern climate, water circulation and landscape under the heads of the *Atmosphere, Weather Maps and Types of Climate, Oceans and Seas, the Earth's Crust, Land Forms, the Work of Running Water, the Work of Ice* and *the Work of the Sea.* The last two chapters, which deal with *Life on the Earth* and *Man and his Occupations,* bring out clearly the objective in all geographical study, the understanding of man's life on earth.

The treatment is simple, clear and methodical; and suggestive practical questions and exercises are given at the end of each chapter. The book, which is illustrated with 63 useful maps and diagrams, may profitably be studied for C. group Geography in Madras schools.

The Columbus Regional Geographies: Senior Series, Book IV: The World of To-day by Leonard Brooks and Robert Finch (University of London Press, Ltd.). Price 3 sh. 6d.

This book by two well-known and experienced teachers of Geography is intended for use by pupils of the School Final stage, who have already covered the study of the continents and the mother-country in the earlier volumes. It is divided into four

parts, the first two of which summarise the chief points of Physical Geography and General World Geography as well as the continental studies of the earlier books, the regional treatment being more advanced; the third part puts the British Empire in its world setting; and the last closes with a summary of all that has been taught in this and the earlier volumes, in the form of a summary of the Major Natural Regions of the World. Exercises are set at the end of each chapter and in connection with several of the maps and illustrations, of which the book contains 147. The treatment is interesting and stimulating, and the get-up neat and attractive.

Junior School Geography by Albert Wilmore (G. G. Harrap & Co., London).

Book I. *Country, Town and Seaside.* 128 pages and 47 illustrations and maps.

Book II. *Peeps at Other Lands.* 158 pages, and 63 illustrations and maps.

Book III. *Britain and the British People.* 168 pages, and 66 illustrations and maps.

These are the first three books of a course of four years' study, intended for English children of the age of seven to eleven, when they are in the Junior School, prepared by a well-known author who is a master of the subject. "The general aim of the series is to awaken interest, to stimulate curiosity, to develop the faculties, to foster the love of knowledge and to awaken a desire for more. It provides the basis for work that will be done in the Senior School."

The 1st Book contains very simple lessons dealing with the homes, school, and immediate surroundings of the children, the emphasis being laid upon the homeland and homely phenomena. In Book II the pupils take peeps at other lands, visiting countries with diverse characteristics, and contrast these with their own native land. They return in III Book to a closer study of Britain and the British people, noting the simple features of structure and climate of the country.

While the interesting descriptions of scenes familiar and strange will rouse the curiosity of the children, the provision of

elementary problems and exercises at the end of each chapter will satisfy their desire for action by doing some simple practical work, suited to their age. Further they will be encouraged to make little excursions in their neighbourhood, and see things for themselves.

A fine get-up and plenty of useful and typical pictures make the books very attractive, while the language is simple and well graduated in the different books. Though primarily written for English children, they can be strongly recommended for use in the middle forms of Indian schools as *supplementary reading-books in English.*

The Physical Basis of Geography by V. F. Searson (G. G. Harrap & Co., London). 260 pages and 83 illustrations and maps.

This book aims at explaining the fundamentals of Geography by means of simple and telling experiments, which are suitable for class demonstration, but which can as well be performed by each student; and the apparatus required has been reduced to a minimum. By a reasoned use of the results of these experiments, the student is helped to understand more clearly the larger forces of nature and the physical processes going on round about him. The human side has not been, however, neglected altogether; and the influence of geographical environment on man and his work has been brought out wherever necessary. Suggestive and typical exercises of varying difficulty are inserted at the end of each section, which serve not only to test the success of the study but also to help the application of the knowledge gained. The book is suitable for use for C. Group Geography in Madras schools.

Principles and Practice of Geography Teaching by H. C. Barnard. (University Tutorial Press, London). 1933. Price 4sh. 6d.

This latest hand-book on the teaching of Geography falls into two parts, which although distinct, are not unrelated. The first seven chapters deal with Geography as an ordinary school subject. After considering in the first chapter the development of Geography teaching, the distinction between the old Geography and the new, the scope of Geography and its relation to the other school subjects, the author proceeds to discuss the Content of School Geography in the next three chapters under the heads of Fact

Knowledge, Geographical Reasoning and Geographical Imagination. Incidentally in chapter IV and specifically in chapter V, the various aids for the teaching of Geography are explained; and in the next two chapters, the syllabus and methods are considered in greater detail.

Chapters VIII to IX are concerned with work in Regional Survey, which the author attempts to connect closely with the Geography syllabus as a commentary upon it, illustrating it from realities round about. Most of his examples have been taken from south-east England; but the general methods suggested are capable of particular application in any locality. The last chapter discusses the place of Geography in education—the aims and values as well as the philosophy behind it. A list of important books on the teaching of Geography and a carefully prepared index add to the value of this useful volume, which can be studied as a text-book in Training Colleges.

A Geography of the World for High Schools: Part II, Section IV—India by N. Subrahmanyam. (The Indian Publishing House, Ltd., Madras). Price Annas 7.

This section completes the Regional Geography of the World, prepared by the author in accordance with the Madras S. S. L. C. Syllabus. Being a study of the native land, the treatment is naturally fuller than in the earlier parts, and the method adopted is descriptive. In the presentation of facts, right proportion has been observed; and local colour adds interest in several places. The book is illustrated with a colour relief map and several other useful maps and diagrams.

A Geography of the World (Tamil): Book III: *Regions of the World* by S. A. Subrahmanya Aiyar and T. S. Anantanarayana Aiyar (T. C. Gopal Pillai). Price As. 12.

The earlier parts of this book were reviewed in Vol. VI, Nos. 3-4 and Vol. VII, No. 2. This part completes the series; and its treatment is similar to that of the earlier books. Schools that teach the subject through the mother-tongue in the High School stage can use the book with advantage, as there are few good text-books in Geography written in Tamil according to the S. S. L. C. Syllabus.

Books and Journals Received

A Geography of the World (Tamil) by S. A. Subrahmania Aiyar and T. S. Anantanarayana Aiyar.

Philips' Informative Geographies: Book I—The Physical Basis of Geography by F. M. Miller (George Philip & Son).

Columbus Regional Geographies: Senior Series: Book IV—The World of To-day by Leonard Brooks and Robert Finch (University of London Press).

The Atlas Geography of the Madras Presidency by S. Ramakrishna Avadhani.

Historical and Statistical Handbook of Sweden (Two volumes) by J. Guinchard (Government Printing Office: Stockholm).

Ancient Inland Dunes of Northern and Middle Europe by Ivar Hogbom (Centraltryckeriet, Stockholm).

Studien in Nordschwedischen Drumlinsland schaften by A. C. Hogbom (Reprinted from the Geol. Instit. of Upsala, Vol. VI, Part 2).

En Kinesisk Vardlskarta Frrn 17: de Arhundradet by K. Ahlenius (Akademiska Bokhandeln, Upsala).

Uber Die Geologische Bedeuntung Des Frostes by Bertil Hogbom (Sonderabdruck aus dem Bull. of the Geol. Inst. of Upsala, Vol. XII).

Contributions to the Geology and Morphology of Siam by Bertil Hogbom (Reprinted from Bull of the Geol. Instit. of Upsala, Vol. XII).

Uber Die Norwegische Kustenplatform von A. G. Hogbom (Reprinted from Bull of the Geol. Instit. of Upsala, Vol. XII).

Eine Theorie Fur die Ursache der Eszeit und die geographischen Konsequenze derselben von Frederick Enquist (Sonderabdruck aus dem Bull of the Geol. Instit. of Upsala, Vol. XIII).

Zur Mechanik Der Spaltenverwerfungen Eine Studie Uber Mittelschewdische Verwerfungsbreccien von A. G. Hogbom (Reprinted from Bull of the Geol. Instit. of Upsala, Vol. XIII: 2).

Der Einfluss Des Windes Auf Die Verteilung Der Gletscher Akademischie Abhandlung von Fredrik Enquist (Sonderabdruck aus dem Bull of the Geol. Instit. of Upsala, Vol. XIV).

On the Geological Importance of Forest Fires by Ivar Hogbom (Reprinted from Bull of the Geol. Instit. of Upsala, XV).

Spaltentektonik und Morphologie Der Schwedischen Skagerrak-kuste Teil I Und II von Erik Ljungner (Reprinted from Bull of the Geol. Instit. of Upsala, Vol. XXI).

Spaltentektonik und Morphologie Der Schwedischen Skagerrak-kuste Teil III: Lieferung I von Erik Ljungner (Hierzu Pl. VIII and IX). (Reprinted from Bull of the Geol. Instit. of Upsala, Vol. XXI).

The Educational Review—May, June and July, 1933.

The Geographical Journal—May, June and July, 1933.

The Indian Educator—April, May and June.

Tirumalai Sri Venkateswara—May 1933.

Youth and Helm—March and April, 1933.

Wealth and Welfare—May to July, 1933.

Indian Journal of Economics—April, 1933.

Kalaimagal—May, June and July, 1933.

The Himalayan Journal—Vol. V., 1933.

Geography—June, 1933.

Bhugol—April, 1933.

Quarterly Journal of the Mythical Society—April, 1933.

The Indian Review—June and July, 1933.

The South Indian Teacher—May, June and July, 1933.

Mitteilungen der Geographischen Gesell Schaft in Hamburgh—Bd. XLIII.

Journal of Indian History—Vol. XII, Part I.

Journal of the Andhra Historical Research Society—Vol. VII, Part IV.

The American Geographical Review—July, 1933.

PROGRAMME OF EXCURSION TO MYSORE DURING THE MICHAELMAS HOLIDAYS

Wednesday,	20th	Sept.	1933.	Departure from Central by Bangalore Express at 1 P.M. Arrival Bowringpet at 6-2 P.M. Supper at the Refreshment Room.
Thursday	21st	„	„	Departure Bowringpet at 7-45 A.M. Arrival at Marikuppam 8-32 A.M. Visit to the Gold Fields 9 A.M.—2 P.M. Departure Marikuppam 3-20 P.M. Arrival at Bangalore City 6-45 P.M.
Friday	22nd	„	„	Seeing Bangalore.
Saturday	23rd	„	„	Leave Bangalore at 7-30 A.M. Arrival at Shimoga at 6-18 P.M.
Sunday	24th	„	„	Gersoppa—To and fro.
Monday	25th	„	„	Bhadravathi—Supper at Berur or Arsikere.
Tuesday	26th	„	„	Departure Arsikere 6-40 A.M. Ar—rival Mysore 5-5 P.M.
Wednesday	27th	„	„	Kannambadi and Seringapatam.
Thursday	28th	„	„	Mysore—Dasara Day.
Friday	29th	„	„	Sivasamudram—Night reach Bangalore.
Saturday	30th	„	„	Back to Madras.

The Journal of
The Madras Geographical Association

Vol. 8. October 1933 No. 3

The Physical Geography of Trichinopoly District

By

Mr. T. N. Muthuswami, M.A.,

Lecturer in Geology, College of Engineering, Guindy.

The inland district of Trichinopoly is bounded on the North by North Arcot and partly by Salem. Salem is to its N. W. also. Coimbatore is to the West of the district. Southern Trichy is wedged in between Madura and Pudukottah. The longest trend of the district is E.N.E.—W.S.W. The northernmost limit touches Lat. 11° 32′ 30″, while the southernmost 10° 17′ 30″. The Eastern and Western limits are 79° 31½′ and 77° 45′ respectively.

The general slope of the country is to the East as evidenced by the Eastward flow of the Vellar on the North and the Cauvery towards the centre. The country is also sloping towards the Cauvery basin both to its North and South. Thus the southern half of the Musiri and Perambalur taluks dips southward.

The Rivers. The Vellar forms partly a natural boundary of Trichinopoly to the North and skirts along the Perambalur taluk; its chief tributaries are Anaivarai Odei and the Chinnar. The latter runs through Perambalur and receives its supplies from Elumur. R. and Koneri. R.

The Kallar, which has its origin on the Eastern flanks of Pachamalais, is joined by the Sweta Nadi from Salem and empties into the Vellar near Peraiyar.

The Cauvery. This river enters the Trichy district from Salem at Neikuppam near Noyil R. S.—then runs N. E. up to Katipalayam ; from here its direction is East to E. S. E. up to Manapalli. Next it turns due S. E. till it is joined by the Amaravati at Timmakadalūr in Karur taluk. Then its run through Trichy is due East, till it crosses the E. boundary of the district at Uttamaseri.

The chief left bank tributaries are Koraipottanar that joins the river a mile East of Sillaipallayaputtur (Musiri taluk) & Ayyar. R. which runs N. to S. through the whole of Musiri taluk. The only river of note that joins the Cauvery to its right is the Amaravati. This enters Trichy from Coimbatore at Manalur (sheet 58 F/13) and forms the natural boundary between the two districts. At Kavundappakavundam (*Lat.* 77°58′ *and Long.* 10°47′) it enters *Trichinopoly,* then runs N. E. enriched by the waters of the Northward flowing Kodavanar. Another stream Nanganni that has its source in Madura, runs East from Karur.

Ariyavur, R. The Mamundi as this one is called in Kulitalai is another tributary of the Cauvery. The waters of the insignificant Koraiyar supply the Mamundi.

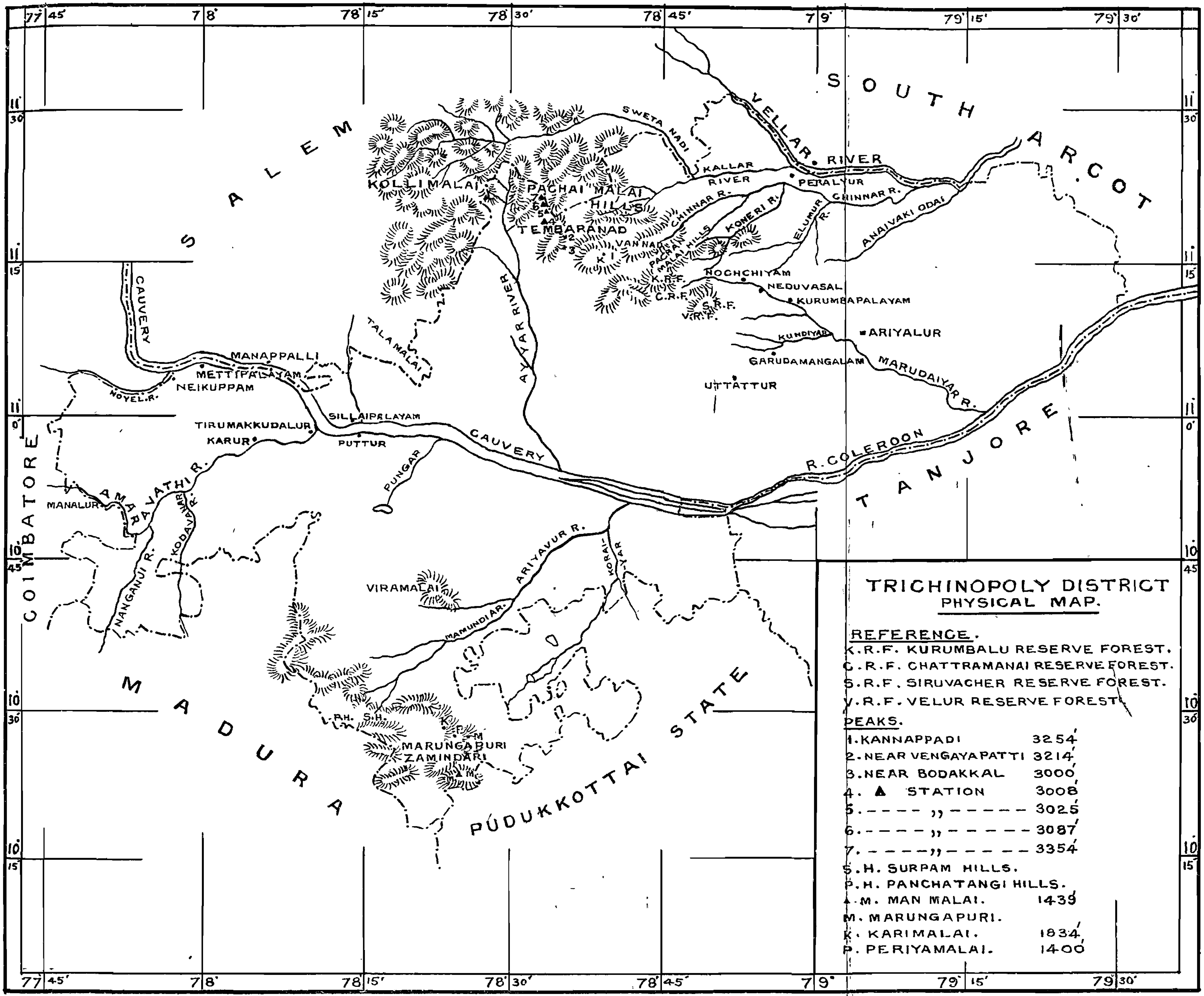
The Pungar in Kulitalai also depends on local showers for its freshes.

Marudaiyar River. This has its origin in the N. W. slopes of Pachamalais and after passing through the southern part of Perambalur taluk, touching Nochchivam, Neduvasal, Kurumbapalayam, is joined by Kundiyar in Ariyalur Zamindary. It crosses Udayarpalayam Zamin and falls into the Coleroon.

Orography. The district for the most part is only a level tract of land, its monotony being relieved slightly by the Cauvery basin and the hillocks that crop out here and there.

The Kollimalais to the N. W. is within Salem limits.

Two spurs of the Pachamalais project into Trichy in the N. N. W. One is covered by Kurambalu and Chattramanai and the other by Velur and Siruvacher reserves. The spurs rise to a maximum height of 1750 feet. The general trend of the Pachamalais is N. E.—S. W. The northern half of the range is divided into an eastern Vannad and western Tembara-nad. In these divisions have sprung up a large number of villages, agriculture being their chief occupation.



TRICHINOPOLY DISTRICT
PHYSICAL MAP.
REFERENCE.
K.R.F. KURUMBALU RESERVE FOREST.
C.R.F. CHATTRAMANAI RESERVE FOREST.
S.R.F. SIRUVACHER RESERVE FOREST.
V.R.F. VELUR RESERVE FOREST.
PEAKS.
1. KANNAPPADI 3254
2. NEAR VENGAYAPATTI 3214
3. NEAR BODAKKAL 3000
4. ▲ STATION 3008
5. ---- ,, ------ 3025
6. ---- ,, ------ 3087
7. ---- ,, ------ 3354
S.H. SURPAM HILLS.
P.H. PANCHATANGI HILLS.
▲M. MAN MALAI. 1439
M. MARUNGAPURI.
K. KARIMALAI. 1834
P. PERIYAMALAI. 1400
SALEM
SOUTH ARCOT
TANJORE
COIMBATORE
MADURA
PUDUKKOTTAI STATE
KOLLIMALAI
PACHAI MALAI HILLS
TEMBARANAD
CAUVERY
R. COLEROON
VELLAR RIVER
KALLAR RIVER
PERALUR
ARIYALUR
UTTATTUR
KARUR
VIRAMALAI
MARUNGAPURI ZAMINDARI

There are very few peaks of over 3000 feet in the Pachamalais. The average height of the range is about 2500 feet.

Peaks of over 3000 feet are noted below:—

		Height.	Lat.	Long.
1.	Kannapadi (Kannimar Shola) ..	3254	78°38	11°16½′
2.	Peak near Vengaiyapatti ..	·3214	78°35′	11°17½′
3.	Peak near Bodakkal. ..	3000	78°36	11°17′
4.	Nameless (a trignometrical station) ..	3008	78°33′	11°18′
5.	Do. ..	3025	78°33′	11°19′
6.	Do. ..	3087	78°33′	11°19½′
7.	Do. ..	3354	78°33′	11°20′

The next important group of hills are those in Kulitalai in the border land between Trichy and Madura.

The Kadavur Zamindary in the district has a unique physiographical feature. It is surrounded on all sides by hills excepting for a mile in the North. Those in the West rise up to a height of nearly 2000 feet. From Kadavur plains the elevations are approximately 2000 feet in the West, and about a thousand on the other sides. The Panjatangi and the Surpam hills on the S. W. border of Kulitalai are low ranges averaging 1300 feet high. In Kulitalai taluk are a number of small hillocks. Viramalai—one of these is a trignometrical station 1612 feet high. This hill is somewhat horse-shoe shaped, the convex side pointing North-west. There are at least three springs in the area. In the Marungapuri Zamindary there are three small hills. They are as follows:

	Height.	Lat.	Long.
Karumalai ..	1834 ft.	78°23′	10°26′
Periyamalai ..	1400 ft.	78°23′	10°26′ approx.
Mamalai (a Trignometric station) ..	1439 ft.	78°24½′	10°23′

Physiographical History. The hills referred to belong to the Archaen complex. They are like the rest of the mountains of the Peninsula, the relics of a big table land of very early geological times. Nothing is known of the Geological history of the district together with others that form its boundary for an immeasurably long period. During what is known as the cretaceous period in the geological time scale, India was subjected to great crustal disturbances of no mean magnitude. There was a marine transgression with the result that Trichy was washed by the sea. Uttatur, Niniyur, Garudamangalam and Ariyalur particularly are so prolific of marine fossils of cretaceous age that Sir Thomas Holland has called this tract of nearly two hundred square miles a little museum of palaeo-zoology. The sea that washed the coast extended as far north as Assam, as the rocks and fossils of cretaceous age in Assam bear a striking resemblance to those of Trichinopoly. Later, the sea very gradually receded in the course of some millions of years to take its present position.

A reference in this connection may be made to the phosphatic deposits at Uttatur which imply the presence of marine fauna and somewhat a shallow sea. The seas during the close of the cretaceous period were particularly charged with phosphatic matter, all over the world. That period also marked the rapid decline—almost to extinction—of gigantic reptiles that then peopled the earth. The marine transgression referred to, resulted in carrying fairly rapidly the huge monster reptiles to localities of different physiographic conditions, causing their decline. The phosphatic deposits are thus nothing more than the phosphate material of the skeletons of those reptiles.

Excepting the Cuddalore sandstone, the formation of which is not yet well understood, we have only the alluvium capping the rest of the district.

The Meteorology of Trichinopoly District

By

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The climate of any region or country depends upon its physical features and those of its surrounding country, and its location on the globe, i.e., latitude, longitude and elevation. In order to make a study of climate of any region regular daily observations of all weather elements as pressure, temperature, humidity, wind velocity and direction and rainfall have to be made in a few representative stations in that region. A collection of such data for a long period enables one to make a proper estimate of the climate of that region.

Trichinopoly is an inland district situated in the south of the Madras Presidency and is lying between 10°16′ and 11°32′ N and 77°45′ and 79°30′ E. It covers an area of nearly 5000 square miles. On the northern side of the district there are small ranges of hills and on the south and south-west the country is broken up by scattered rocky heights. Elsewhere the district consists of an undulating plain dotted here and there with isolated masses of rock of which the great Trichy rock, the Golden rock and the Ratnagiri hills are prominent examples. The total hilly area of the district is nearly 200 square miles, and the maximum height of the peaks in the hilly tracts is nearly 4500 feet above the sea. The slopes of these hills are covered with trees and shrubs and a large part of them has, been constituted reserved forest. The most important rivers of the district are the Cauvery and its branch the Coleroon. Next in importance is the river Amaravati which runs a total course of nearly 140 miles. These rivers are of very great economical importance to the district as they irrigate a large tract of land. Besides the above-mentioned rivers there are a few small ones which also serve irrigational purposes.

There is only one meteorological station in the district at its capital. A comprehensive idea of the climate of the district can be had, however, by a study of the meteorological records of other

stations situated all round, viz., Salem to the north, Coimbatore to the west, Negapatam to the east and Madura to the south. In addition to these meteorological stations there are a number of rainfall-registering stations the records of which are also helpful for a climatic study. A few important weather elements as recorded at different stations will now be discussed.

Both human and plant life are sensitive to heat and cold. The quantitative measure of heat is expressed as temperature in different scales according to the convenience of different investigations. In weather science it is usual to express the temperature of the air in Fahrenheit scale. Table 1 gives the mean maximum and minimum temperatures as recorded at different stations under consideration for each month of the year. Of the 5 stations except Negapatam all the others are inland ones, situated at different elevations. The temperature at any place depends upon its location. The temperature is higher at sea level than at higher elevations and higher at inland than at coastal stations. The table shows that the mean monthly temperatures are the lowest at Coimbatore having the greatest elevation of all the stations, and the temperatures at Negapatam are lower than at Trichinopoly or Madura both of which are inland and are at elevations lower than 500 feet. At Trichinopoly there is a progressive increase of mean temperature from month to month from December to May and then there is a progressive fall from May to December. It may be noticed that neither the rise nor the fall is regular. The rise from December to January is only 0.2°, January to February is 3°. In March the direction of wind (see table 3) changes to east and has a travel over a heated land surface, and so the rise of temperature increases to 4.7°. In April the wind changes to E. S. E., still blowing from hot tracts of land and the rise in temperature is maintained at 4.2°. In May, the direction of wind is W.S.W., i.e., the wind is travelling at least a part of the way on the cool sea and there is a check to the rise of temperature which is only 0.8°. In June the cool strong western wind blowing through the Palghat gap sets in and the mean temperature begins to fall steadily. Up to September the direction of wind is predominantly westerly, and there is a steady fall of about 1°.0 in temperature from month to month. In October, November and December when the north-east monsoon is very strong the temperature falls more rapidly by about 3° from September to October and from October to November: when the rains begin to abate there is a slight check to the fall of temperature in December, while in January there is a slight rise. Simi-

larly we find a progressive rise and fall in temperature from month to month in other stations which can be explained by the movements of wind and the nature of the surface on which they travel (See curve of March of temperature Fig. V).

The mean maximum temperature is higher at Trichinopoly than at any other station. Though Madura is at a higher elevation than Trichy, the latter station records a higher maximum temperature in May which is probably because of the Trichinopoly Rock which radiates heat during the day and increases the maximum temperature. The influence of the rock is also noticeable in the mean monthly minimum temperatures of Trichinopoly. In January, the coldest month of the year, the mean minimum for the month is 1·3° lower at Trichinopoly than at Madura. The range of temperature (the difference between maximum and minimum) also shows that the figures are higher at Trichinopoly than at Madura during all the months of the year except from June to October when there are rains.

Trichinopoly is more humid than Madura. The mean monthly humidity decreases from January to June, thereafter it gradually increases. The mean monthly cloudiness of the sky is below 3/10 of the visible sky during the period January to March, thereafter it gradually increases up to July the cloudiest month and again it decreases up to September. The cloudiness increases in October with the onset of the N. E. monsoon and gradually decreases till it again begins to increase in April. Madura is more cloudy than Trichinopoly and the increase of cloudiness there from the dry season to the monsoon months is greater and the decrease from the rainy season to the dry season is also greater. Salem is the least cloudy of all stations and on account of the clearness of its skies the mean monthly range of temperature is greater than in any other station.

Rainfall is a climatic factor of great economic importance to any country. A moderate fall of rain on a larger number of days is of greater value to the agriculturist than a heavy downpour on any single day. Therefore the significance of rainfall in any region should be considered in relation to the number of days on which the rain falls. Trichinopoly records an annual rainfall of about 33 inches in about 45.0 days. In Coimbatore the annual rainfall is about 22½ inches and the number of days of rainfall is

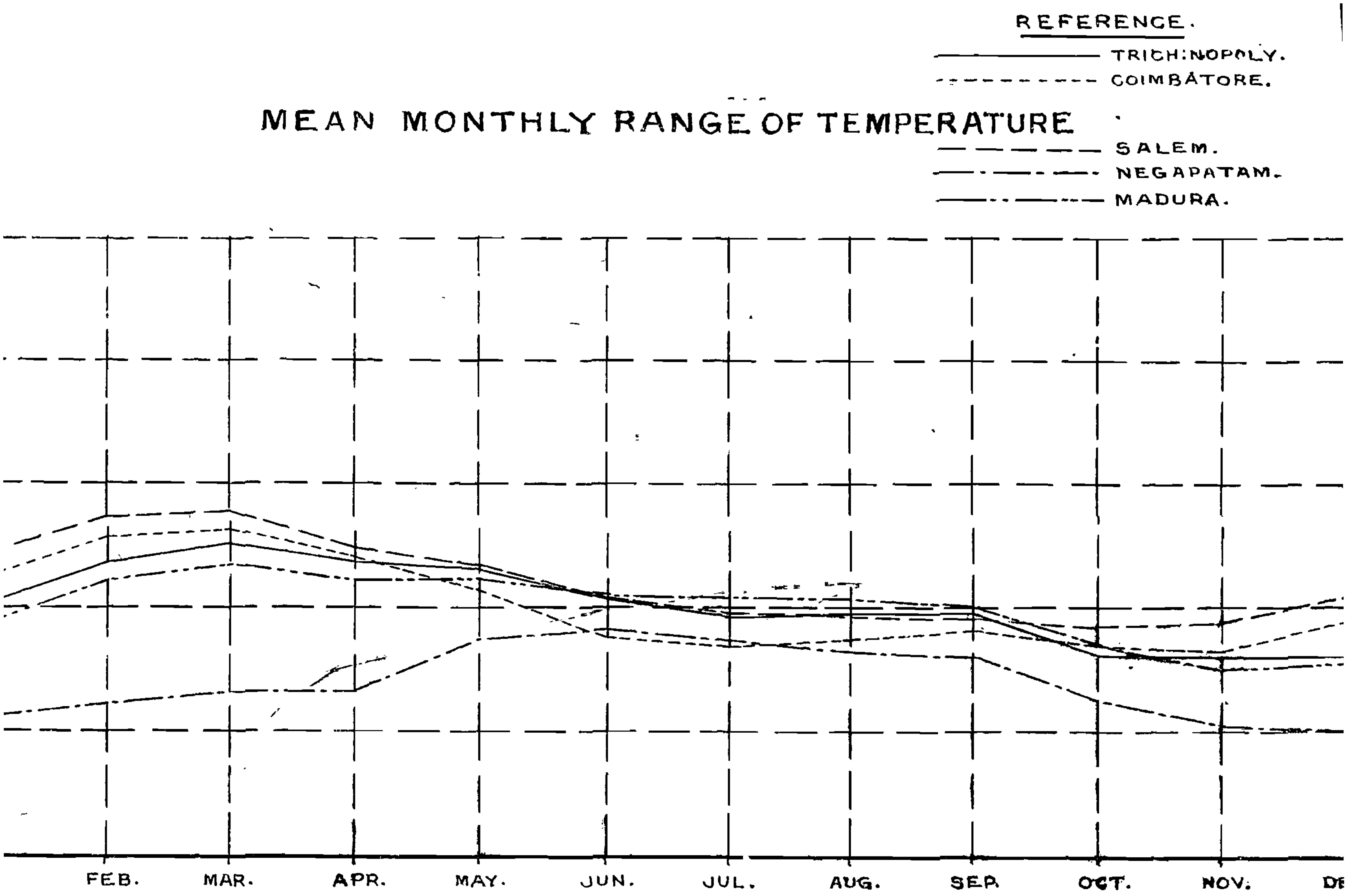
60. *Rain is much more frequent* in Coimbatore than in Trichinopoly.

	Jan.-June. inches.	April-May. inches.	June-Sep. inches.	Oct.-Dec. inches.	Total. inches.
Trichinopoly	1·67	4·79	11·64	15·08	33·18
No of days	(2·4)	(5·5)	(16·0)	(21·5)	(45·40)
Coimbatore	1·44	3·80	5·76	11·34	22·34
No of days	(3·2)	(10·0)	(30·0)	(16·50)	(59.70)

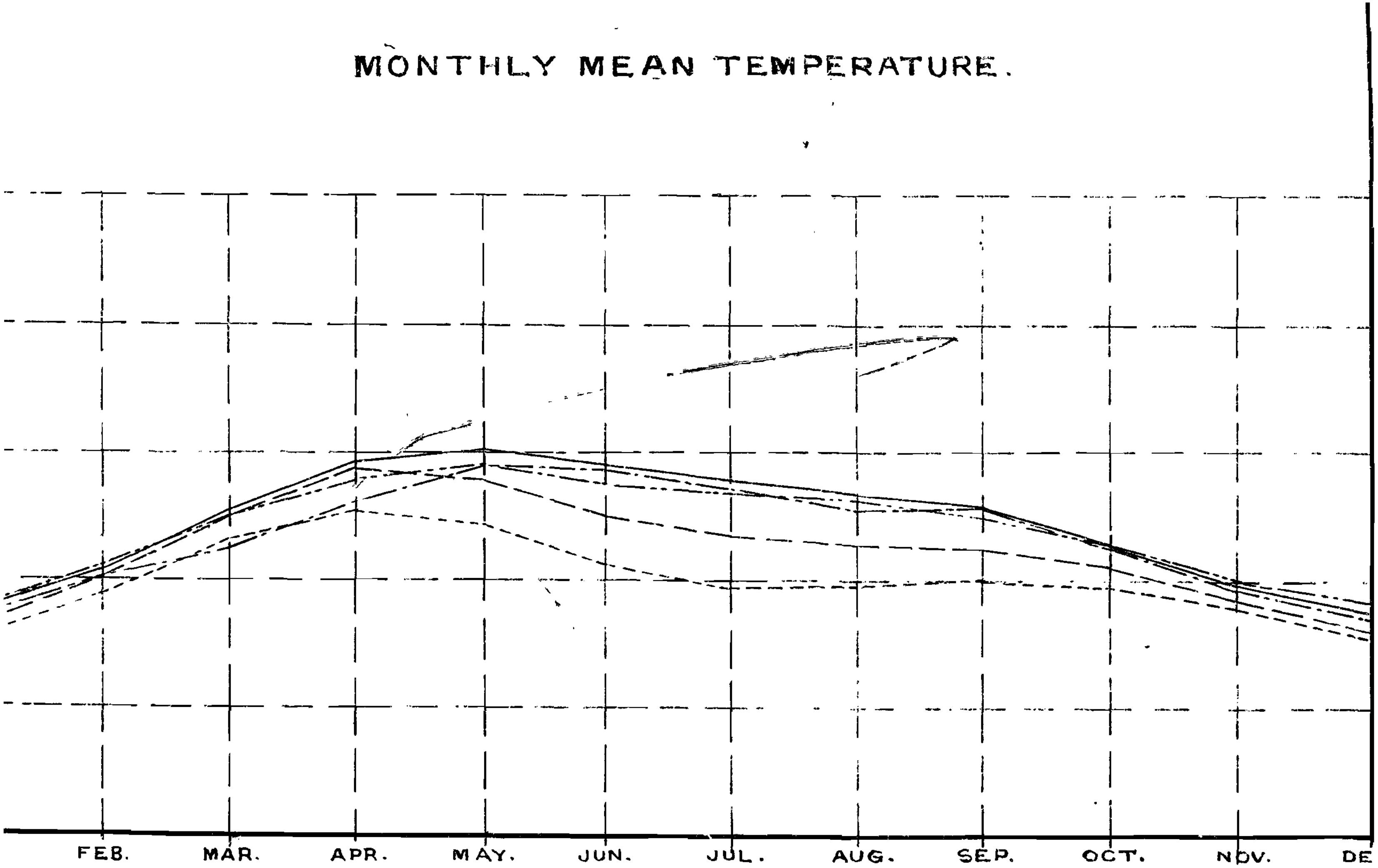
From the table given above we find that about 4.8 inches of rain fall in Trichinopoly during April and May in 5.5 days while only 3.8 inches in the same months fall in 10 days in Coimbatore. Throughout the year rain is more evenly distributed in Coimbatore than in Trichinopoly.

The average annual rainfall for the whole district of Trichinopoly is about 33.8 inches. There are 16 meteorological rainfall registering stations and there may be many more rainfall stations under the revenue department and local bodies. The highest annual rainfall of 43.16 inches occurs in the district at Jayankondan and the lowest of 24.9 inches at Aravakurichi. In this part of the country the rainfall is well distributed in time, and so is more reliable than regions where there are concentrated falls of rain. The variations of rainfall in any year are never more than 25% on either side of the normal. This small variation from the normal rainfall and also its distribution in time is of great economic importance to the agricultural production in the district.

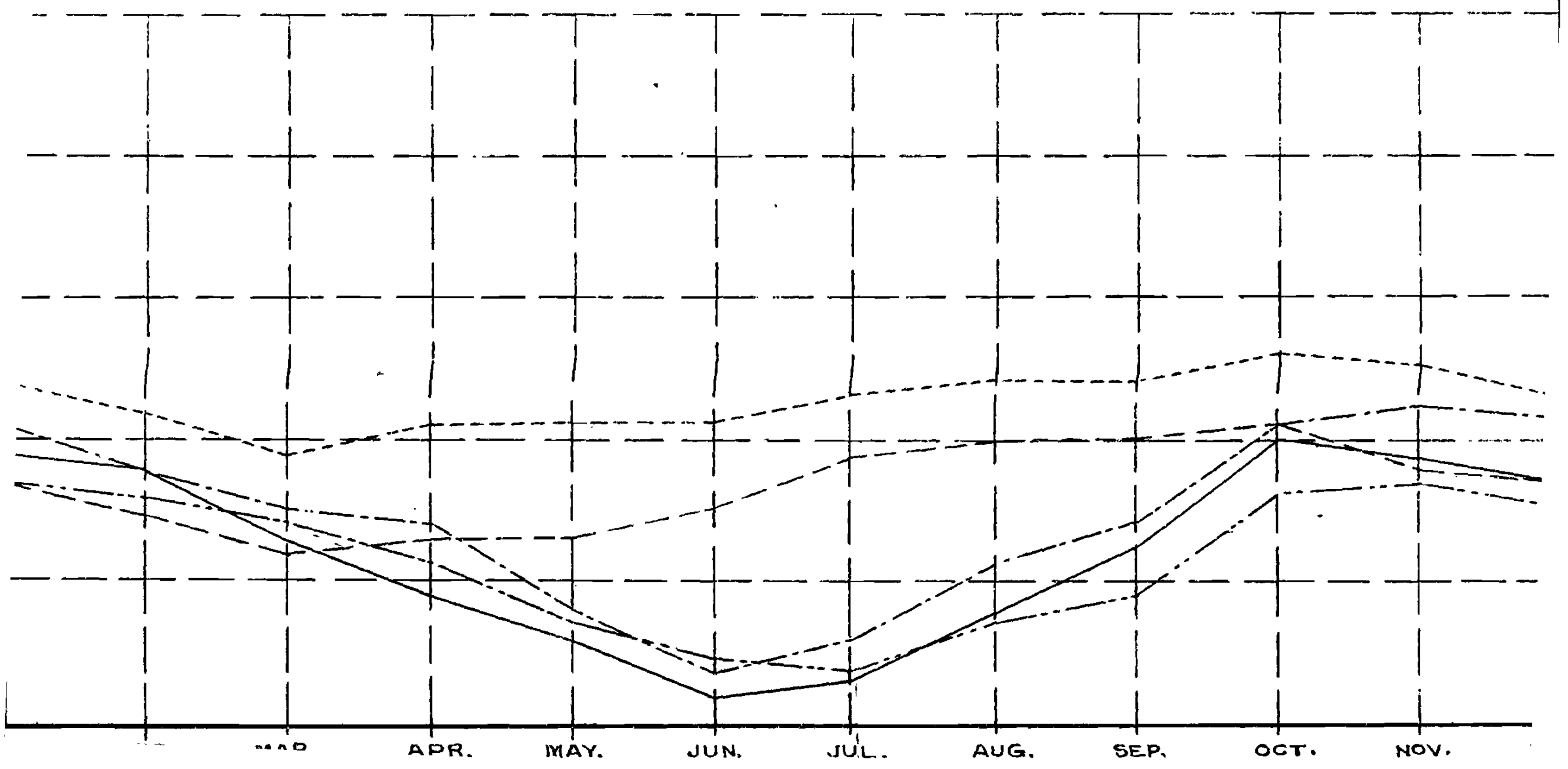
MEAN MONTHLY RANGE OF TEMPERATURE



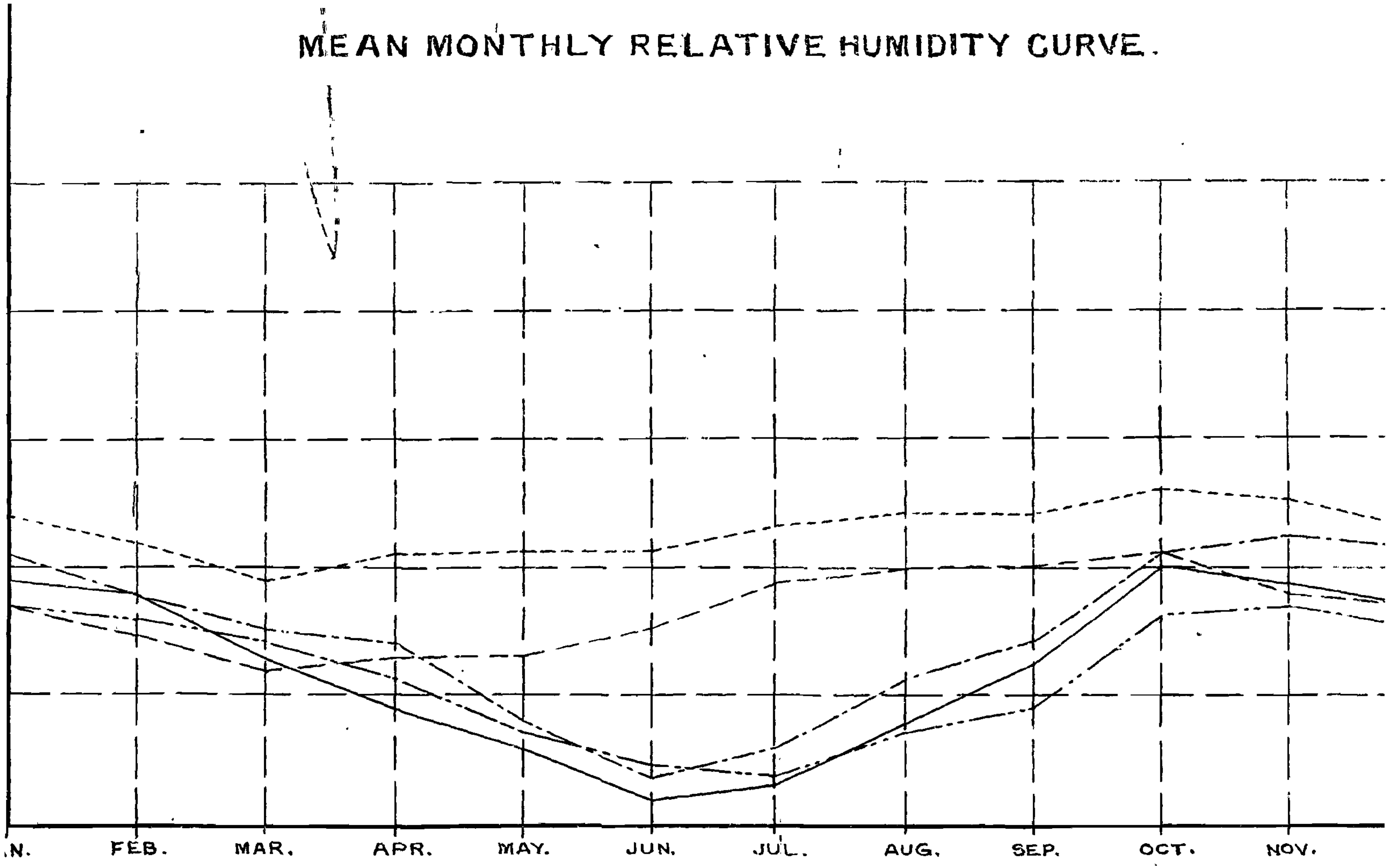
MONTHLY MEAN TEMPERATURE.



MEAN MONTHLY RELATIVE HUMIDITY CURVE.



MEAN MONTHLY RELATIVE HUMIDITY CURVE.



MARCH OF TEMPERATURE FROM MONTH TO MONTH.

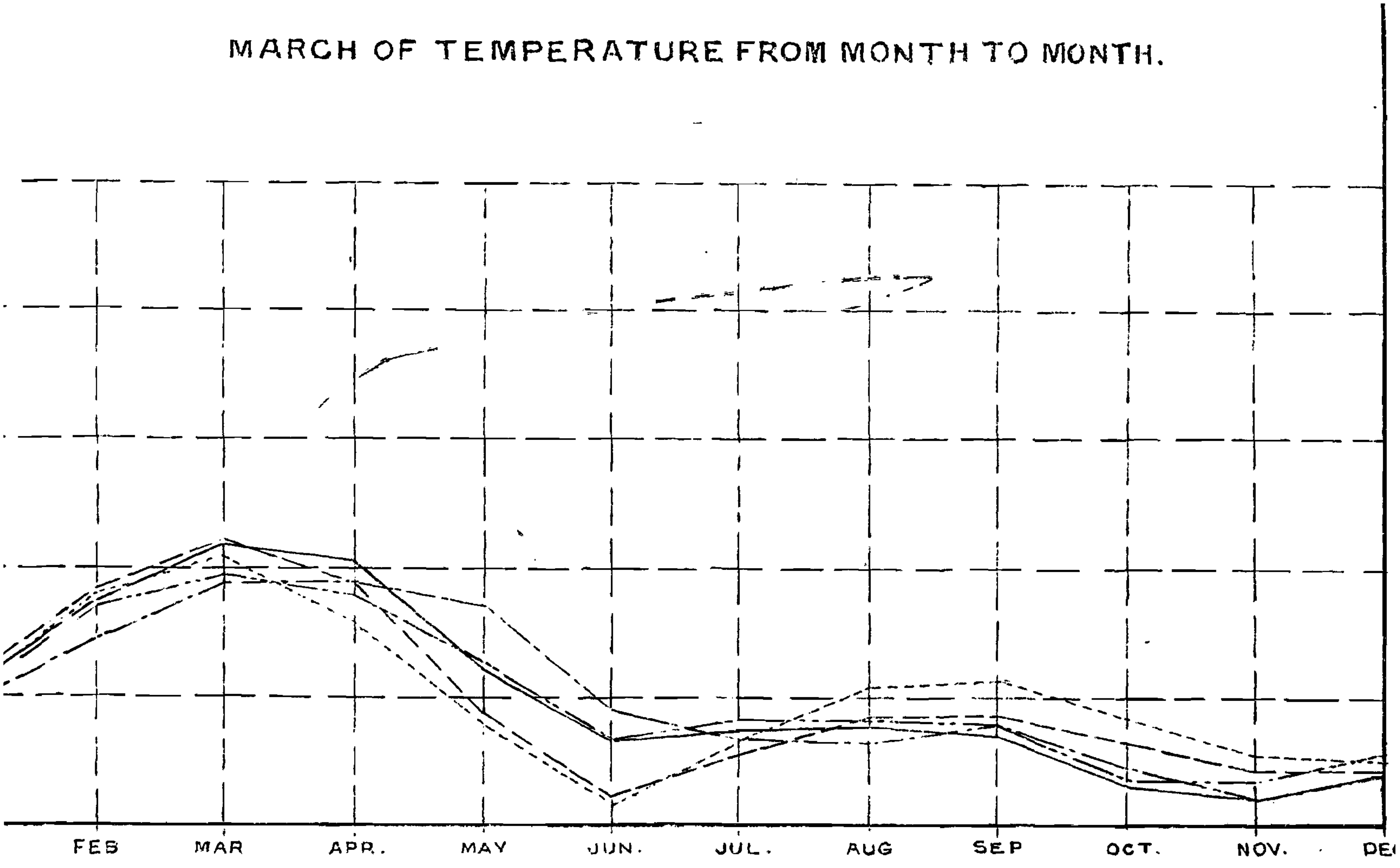


TABLE I :—TEMPERATURE.

Months.	Trichinopoly Elevation :—275 ft. Max.	Mean	Min.	Range.	Coimbatore. 1348 ft. Max.	Mean.	Min.	Range.	Salem 4 Max.	Mean.	Min.	Range.	Negapatam Max	Mean.	Min.	Range.	Madura 448 ft. Max.	Mean.	Min.	Range
January	87.5	77.5	67.5	20.0	86.7	75.5	64.4	22.3	88.6	76.5	64.4	24.2	82.4	76.9	71.4	11.0	87.4	78.1	68.8	18.6
February	92.3	80.5	68.8	23.5	91.7	78.8	65.9	25.8	93.6	79.9	66.2	27.4	84.8	78.7	72.7	12.1	91.9	80.9	69.9	22.0
March	97.7	85.2	72.7	25.0	96.2	83.0	69.8	26.4	98.7	84.8	70.9	27.8	88.8	82.3	75.9	12.9	96.5	84.7	72.9	23.6
April	101.1	89.4	77.7	23.4	97.2	85.3	73.5	23.7	100.8	88.5	76.2	24.6	92.7	86.0	79.3	13.4	99.0	87.9	76.7	22.3
May	101.7	90.2	78.7	23.0	94.8	84.1	73.5	21.3	99.5	87.9	76.2	23.3	97.6	88.9	80.2	17.4	100.0	88.8	77.6	22.4
June	99.0	88.8	78.6	20.4	89.6	80.7	71.8	17.8	95.3	84.9	74.5	20.8	97.6	88.5	79.4	18.2	98.0	87.5	77.1	20.9
July	97.4	87.7	77.9	19.5	87.7	79.3	70.8	16.9	93.1	83.1	73.2	19.9	95.9	87.1	78.4	17.5	96.9	86.7	76.4	20.5
August	96.5	86.7	76.8	19.7	88.2	79.5	70.8	17.4	92.1	82.5	72.8	19.3	93.9	85.6	77.3	16.6	96.3	86.0	75.8	20.5
September	95.2	85.5	75.8	19.4	89.1	79.9	70.7	18.4	91.5	81.9	72.3	19.2	92.7	84.7	76.7	16.0	95.1	85.1	75.2	19.9
October	91.1	82.7	74.3	16.8	88.1	79.3	70.6	17.5	89.7	80.5	71.4	18.3	88.7	82.5	76.2	12.5	91.1	82.5	74.0	17.1
November	87.3	79.6	71.9	15.4	86.0	77.4	68.8	17.2	87.5	78.1	68.7	18.8	84.5	79.4	74.3	10.2	87.4	79.9	72.4	15.0
December	85.4	77.3	69.3	16.1	85.0	75.4	65.8	19.2	86.4	75.9	65.4	21.0	82.1	77.1	72.1	10.0	86.1	78.1	70.2	15.9
Annual	94.3	84.3	74.2	20.1	90.0	79.9	69.7	20.3	93.1	82.1	71.0	22.0	90.1	83.1	76.2	13.9	93.8	83.9	73.9	19.9

TABLE II :—HUMIDITY, RAINFALL & CLOUD AMOUNT.

Months.	Humidity.					Rainfall.					Cloud Amount.				
	Trichinopoly.	Coimbatore.	Salem.	Negapatam.	Madura.	Trichinopoly	Coimbatore.	Salem.	Negapatam.	Madura.	Trichinopoly.	Coimbatore.	Salem.	Negapatam.	Madura.
	%	%	%	%	%										
January	79	84	77	81	77	0.68 0.7	0.64 0.5	0.31 0.4	1.68 0.7	0.60 0.8	31	43	29	52	29
February	78	82	75	78	76	0.56 0.7	0.32 0.8	0.27 0.6	0.63 0.9	0.36 0.9	26	41	22	44	29
March	73	79	72	75	74	0.43 1.0	0.48 1.9	0.48 1.2	0.34 0.5	0.51 1.4	26	36	19	40	27
April	69	81	73	74	71	1.65 2.5	1.44 4.0	1.79 3.0	0.57 1.9	2.03 3.5	38	41	36	43	35
May	66	81	73	68	67	3.14 3.0	2.36 6.0	4.72 5.5	1.61 2.0	2.89 4.0	43	40	33	41	53
June	62	81	75	64	64	1.41 2.0	1.66 7.5	3.02 3.5	1.30 2.5	1.37 2.0	57	60	47	56	69
July	63	83	79	66	64	1.57 2.0	1.46 7.5	3.82 5.0	1.89 3.5	1.92 2.0	61	66	57	63	79
Aug.	68	84	80	71	67	3.83 6.0	1.13 7.5	6.84 6.5	3.59 6.0	4.25 5.0	55	65	55	60	71
Sep.	72	84	80	74	69	4.83 6.0	1.51 7.5	6.59 6.0	3.77 6.0	5.11 4.5	51	61	51	56	69
Oct.	80	86	81	81	76	6.90 7.5	6.41 9.0	6.74 7.5	10.48 10.0	7.82 10.0	56	58	52	57	64
Nov.	79	85	78	82	77	5.57 9.0	3.75 6.0	3.74 7.0	17.72 13.0	4.95 7.0	53	49	50	54	61
Dec.	77	83	77	82	75	2.61 5.0	1.18 1.5	0.98 2.0	11.34 9.0	1.77 4.0	48	39	46	47	53
Annual.	72	83	77	75	71	33.18 45.40	22.34 59.7	39.34 48.20	54.92 56.00	33.58 45.10	49	45	43	46	59

(Figs. given in the 2nd row against each month under rainfall indicate the number of rainy days.)

TABLE III :—WIND DIRECTION.

Months.	Trichinopoly	Coimbatore.	Salem.	Negapatam.	Madura.
January.	N.E.	E.N.E.	E.	N.E.	N.E.
February.	N.E.	E.	S.E.	N.E.	E.N.E.
March.	E.	S.E.	S.	S.E.	E.
April.	E.S.E.	S.S.E.	S.W.	S.E.	S.E.
May.	W.S.W.	S.S.W.	S.W.	S.S.W.	S.S.W.
June.	W.	S.W.	S.W.	S.W.	W.S.W.
July.	W.	S.W.	S.W.	S.W.	W.N.W.
August.	W.N.W.	S.W.	S.W.	S.W.	N.W.
September.	W.N.W.	S.S.W.	S.W.	S.W.	N.W.
October.	N.W.	S.S.E.	S.W.	S.W.	N.W.
November.	N.E.	E.N.E.	E.	N.E.	N.N.W.
December.	N.E.	N.E.	N.E.	N.E.	N.E.

TABLE IV :—MONTHLY MARCH OF TEMPERATURE.

Month.	Trichinopoly.	Coimbatore.	Salem.	Negapatam.	Madura.
January	+0.2	+0.1	+0.6	0	—0.2
February	+3.0	+3.3	+3.4	+2.8	+1.8
March	+4.7	+4.2	+4.9	+3.8	+3.6
April.	+4.2	+2.3	+3.7	+3.2	+3.7
May.	+0.8	—0.8	—0.6	+0.9	+2.9
June.	—1.4	—3.4	—3.0	—1.3	—0.4
July.	—1.1	—1.4	—1.8	—0.8	—1.4
August.	—1.0	+0.2	—0.6	—0.7	—1.5
September	—1.2	+0.4	—0.6	—0.9	—0.9
October.	—2.8	—0.6	—1.4	—2.6	—2.2
November.	—3.1	—1.9	—2.4	—2.6	—3.1
December.	—2.3	—2.0	—2.2	—1.8	—2.3

The Influence of Physical Features on the Human Geography of the Trichy District

By

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I have taken for the subject matter of my paper before the Geographical Conference, " The influence of the physical features of the Trichy District on the history, the means of communication and economic conditions of the same." In dealing with this subject I have had two things prominently in view, first the mutual relationship of and influence on the two factors indicated in yesterday's learned Presidential address as the theatre and the actor; and secondly, the study of the area not merely as the *home* of man which suggests mere static conditions, but as the *path* which he treads and retreads in order to find a settled and increasingly comfortable home, utilising advantages and overcoming obstacles, a process still in continued operation.

A comparison with other districts would be useful even at the outset. Madura has no river deltas; Tanjore is the land of deltas; Coimbatore is the land of hills and tanks. Tanjore and Madura have sea coasts. Coimbatore, Salem and Trichy are entirely inland districts. But Trichy differs from Salem and Coimbatore in that it is blessed with the passage, in its very heart, throughout its length, of the most important river of South India. It differs from Tanjore in that the splitting of this river into so many branches confers an inestimable advantage on the agriculture of that district which is, moreover, the recipient of all the alluvial deposit collected all through its course from its place of birth in Kodagu till its branches lose themselves in the sea by various mouths. Tanjore would not enjoy all this benefit if there had been another land portion interposed between itself and the sea. To-day a substantial portion of this alluvial deposit has been diverted by the Kannambadi Dam. The constructors of the Mettur Dam have been the modern rivals and supplementers of the great Chola Rulers who were responsible for the construction of the numerous irrigation channels of the Tanjore District. But the situa-

tion of the Trichy District and the distribution of hills, valleys and plains, with the Cauvery tearing itself through its very bosom gives it a peculiar importance shaping, in fact determining, its history from the earliest times. Salem and Coimbatore may be vastly richer in their natural resources but they cannot lay claim to even a portion of the wealth of tradition and history that belong to Trichinopoly. To the modern Indian it is only the key to the Carnatic during the Anglo-French wars, with History centering round Trichinopoly alone with its Clive's House and the Pallava Caves in the rock. But the geographical situation and features and their effect on the history of this area have never received the measure of attention that they deserve.

There has been no important ruling race south of the Vindhyas in India from the earliest times that has not been in some way or other connected with this district. The ancient Tamil Kingdoms of Chera, Chola and Pandya, the Andhras, the Pallavas, the Chālukyas, western and eastern, the Gangas, the Hoysalas, the Vijayanagar and Mohammadan kings, the Mahrattas, the Nayaks, Hyder and Tippu, the French and the English and the Nawabs of the Carnatic have all made this territory the great amphitheatre of their warlike operations. No other district in South India can boast of so many distinguished connections, not even Madura. No other district abounds in such and so many inscriptions. All these must be traced to the position of the district as a whole and to the intriguing arrangement and disposition of the hills and valleys and the rivers of the district as the map will show.

Nature and boundaries of the District. The district is not hilly like Coimbatore, nor a plain like Tanjore, nor hemmed in like Madura between hill and sea. It is a single broad long valley stretching from west to east, the first and most important step in the descent from the Mysore plateau. This will be clear when we attend to the nature of the river-bed above and below Erode; in the former, it is full of rocks, in the latter, it is completely sandy. The course of the river is determined by the Kollimalais and the Pachamalais in the north, and the low Viralimalai heights in the south on the borders of the Madura District between which the river has scooped out for itself a valley of its own. The high grounds of the Coimbatore District slope north-eastward; those from Salem, south and south-eastward. The arid tracts of the Budalur area divide it from the Tanjore deltaic area, while the jungle hills of Ayalur intervene on the side of Madura and intro-

duce us to the characteristics of Pandyanad. It thus serves as the communicating ground, in the north and north-western frontier, of the three Tamil states whose armies could not avoid this area especially its eastern portion where the two greatest of the later Cholâs chose to build their capitals in preference to those in the Tanjore area which they deliberately abandoned. Karur, a railway station between Erode and Trichy is, according to a Tamil author of repute, said to have been the capital of the Chera kings ; and this must have been on the Chera borders which must have been prevented from further expansion eastward by the Chola dominions lying beyond. Kottaikarai in the Kulittalai taluk is said to have been the meeting point of the three frontiers, according to Avvaiyar. The course of the Cauvery has had no small share in the location of these places whose strategic importance is equally clear. The boundaries of these states had been constantly varying according to the vicissitudes of their never-ending wars ; and all these variations had been within the confines of this district. The Hoysala Ballalas whose capital was in North Mysore built under their King Vira Someswara a capital of importance a few miles west of Samayapuram having felt the need for such a one in the wars with the Pandyas in the early part of the 13th century. About 130 A.D. Ptolemy refers to Woriur as the Chola capital. This persistent tendency on the part of rulers to establish their capitals within this area must be ascribed to the geographical position and the strategic importance of this district from an inland aspect. This truth has been picturesquely expressed in the phrase describing it as the "Key to the Carnatic." The truth is that it had been the key to older and larger territories from north to south, west to east, north-west to south-east, to the Gangas from Talakad, the Hoysalas from North Mysore and to the Vijayanagar and Mohammadan kings. The Cauvery in this district opened up to the invading hordes from Mysore, Maharashtra and Malkhed the territories to the east and south of the river. Through the gorge near Erode and Talakad came the Gangas ; the Hoysalas, Vijayanagar kings, and the Mahrattas poured in on either side of the Kollimalais and the Pachamalais. What the Ganges has been to North India betraying to the distant invader precious tracts that would have otherwise remained unknown, the Cauvery has been to South India. The district has been what the Cauvery and the paths leading into it from north, west and south have made it. The long and chequered history of South India from the earliest times would not have been what

it is but for these broad hints into this hinterland, and the longer, broader and more open lead given by the Cauvery.

One curious thing must be noted here. The modern mind is *oblivious* to the effect of the relationship and disposition of, land and water, hill and valley, river and slope, and has accustomed itself to travel only along the railway line, halting, of course, at Refreshment Rooms and forming notions of a tract from impressions of what was seen only during the railway journey much of which might have been performed during the nights. For instance, the nearness of Hosur to Erode and Ramnad to Arantangi is conceived according to the railway journey, covering the places. As for the knowledge of the historical importance of places, specimens can be furnished here. Trichy is noted for its Clive's House and Woriur for its Cheroots and beedies, Samayapuram for its Mariamman Koil. Gangaikonda Cholapuram and Jayakonda Cholapuram sound strangely though gloriously. Kottaikarai is unheard of. Thus the moderner loses sight and grasp of the essentials of the natural situation, the natural setting amidst environments and the influences exerted and subjected to by the relationship of distances and the existence or otherwise of barriers. The importance of Trichy is not due to racial or political achievements in its area, but is territorial, geographical, situational.

The old means of communication and the way in which they were utilised with none of the modern means of transport appear really remarkable especially with the limited knowledge of Geography then prevalent from our point of view. Prodigious hosts swept down the Erode gorge and the slopes on either side of the Kollimalais and the Pachamalais from the plateau and moved even more directly if less rapidly than the present railway system can think of. The running of the railway from Erode to Trichy parallel to the old road and the Cauvery is a modern recognition of the tribute to the old understanding of distances.

The original policy of railway construction had been to pursue literally the lines of least resistance and the need for supplementary and chord lines was felt only later with the result that the older and more direct paths laid down by nature and pursued by our forefathers were re-grasped and re-captured and places of obsolete reputation have been brought in the path of the pilgrim's progress from the north to Rameswaram. The motor bus has made a dis-

tinct contribution to the realisation of this lost thread (tread). The road from Madura via Dindigul to Palani and Karur lets the southerner into the secrets of the Cauvery path, a corresponding service being rendered from the Salem side by the road from Salem via Namakkal and meeting the southern road near Karur at Vangal and Mohanur which keep an eternal vigil on each other from either bank of the river at its broadest here.

The sense of proportion of distances prevailing among us before the advent of the Railway was remarkable and may be illustrated by two among many facts. Mineral waters from Dindigul and from Pachiparai 2 miles to the west of Erode were being carried daily to Seringapatam to quench the thirst of Tippu Sultan. The world is not only too much with us now but even near places are far from us so far as our knowledge of their relationship goes. We are now at the mercy of the Railway route.

The construction of Railways has resulted in an unconscious avoiding of old centres of business, industries and population and the creation of new ones. Economic forces operate in two directions. Places attract business and business creates new places or expands old ones. An example of the former is the erection of spinning mills in Madura, and the removal of the S. I. R. workshop to Trichy; of the latter, the creation of the Golden Rock colony is a striking instance. The construction of Chord and Branch lines has rescued important places, lying remote, from undeserved obscurity and seclusion. The result is a reshuffling of centres of population and business and throwing new light on old places. The process is yet going on.

Ever since the inception of the S. I. R. system, Trichinopoly has been its headquarters and the removal of the workshop from Negapatam, in spite of its being an important port on the E. coast and the creation of the Golden Rock Colony which has metamorphosed in a very short period a forlorn wilderness into a beautiful modern town is a golden recognition of the truth which had appealed to the Chola and the Hoysala, the Pallava and the Saluva and the Naick and Mohammadan rulers who had chosen the sites for their capitals in this area. Dr. Buchanan travelling in 1803 through the Erode gorges, testifies to the existence of flourishing communities near Jolarpet and the present Cauvery station. The old

order changes yielding place to new, but the new is forced, not unoften, to turn to the old.

Our ancestors seemed to have had a better understanding and grasp of the realities and possibilities of the natural setting of a tract and its inherent situational advantages and disadvantages, deriving the necessary stimuli for action, as is evident from their choice of sites for their capitals, the lines of march of their armies and the scenes of battles, though, in the last case, chance was largely the determining factor. Momentous battles were fought near Samayapuram, Tiruppurambiyam near Kumbakonam, at Takkolam near Arkonam and at Kuppam. These were places predestined by nature to be the meeting place of contending armies; nor were the selections of sites for capitals the result of accident or caprice.

Regarding the influences of the physical features on the economic conditions of this area we find no single dominant characteristic of nature to impress on the inhabitants its distinctive trait as in the case of Malabar, Madura or Tanjore. The rainfall is not deficient but the climate is enervating enough. Trichy is not the granary that Tanjore is; nor do cotton and sugarcane grow in it as in Coimbatore; no tea and coffee estates are here as Salem and Coimbatore have; no forest wealth similar to that of Madura; it is neither deltaic nor pastoral; it has in a limited and unco-ordinated measure all these tracts. The borders on the east, west and south have an unpromising soil. The concentration of population is in the Kulittalai, Trichy and Lalgudi taluks where agriculture is considerably advanced. Perambalur and Ariyalur grow cereals and cotton with sheep-farming on a large scale. Unending lines of double-bullock bandies with loads of cotton bales and the lantern dimly burning between the wheels made their monotonous way for years along the bridges on either side of Srirangam reducing their standing capacity to the vanishing point when the floods of 1925 washed both of them away in the silence and secrecy of a single night. To-day the Railway running through the heart of these taluks must have deprived these bandies of not only their load but also of their bread.

Such economic conditions resulting from what gifts nature has bestowed on this area in this manner are not very favourable for the development of any noteworthy aptitude on the part of the people. The same might also account for a literary and educational

development as evidenced by the number of Collegiate and Secondary Institutions in this district. The population under the stress of modern economic forces seem to have the need in the future for gravitating towards Perambalur and Ariyalur exploiting and utilising the cotton, cereals and wool available there. Under modern conditions all the old paths including the railway route will have relatively diminishing importance; while space, distance and barrier and even the influence of the physical features on man will count for little under the one supreme and irresistible touch of modern progress and all that it stands for, as a result of which, distance is obliterated, accommodation enlarged, resources multiplied and the various peoples of the earth are drawn close, it is hoped, for more peaceful and friendly intercourse and association than we have indications of at present.

Irrigation in Trichinopoly

BY

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Irrigation in Trichinopoly forms a very interesting subject for study, for this district is neither too flat like Tanjore nor too hilly as Salem or Coimbatore. The land slopes from north and south towards the middle of the district, i.e., the valley of the river Cauvery. The Cauvery enters our district at the north-west, turns eastward and takes a north-easterly course. As it flows at the lowest level in the middle of the district it forms the natural drainage practically for the whole of this district.

The only lands that could be irrigated with ease are those very near the river, because the land rises gradually higher and higher up on either side of it. The adjoining sketch will represent the general plan of irrigation and drainage arrangements provided in this district. In order to irrigate a piece of land some 2 miles north or south of the river the channel should take its source 10 miles up the river. When the channel has been constructed to irrigate lands which are a few miles north or south of the river, provision has to be made to dispose of the drainage water. This is done by weirs in the case of large streams or Kattuvarries (காட்டுவாரிகள்) as they are called. In the case of minor drainage channels under-tunnels are provided. Hence there is very little scope for extending the land under Cauvery irrigation in this district on account of the engineering difficulty in encountering with uneven surface. So, the Mettur reservoir has very little to benefit this district in extending the area under irrigation.

Kodingal, Kodamuruthi, Kilivaivaikal, and Kovalavaikal are the main drainage channels in this district. The first two take off from Uyyakondan, and finally empty into the Cauvery near Trichinopoly Town and the last two near Grand Anicut.

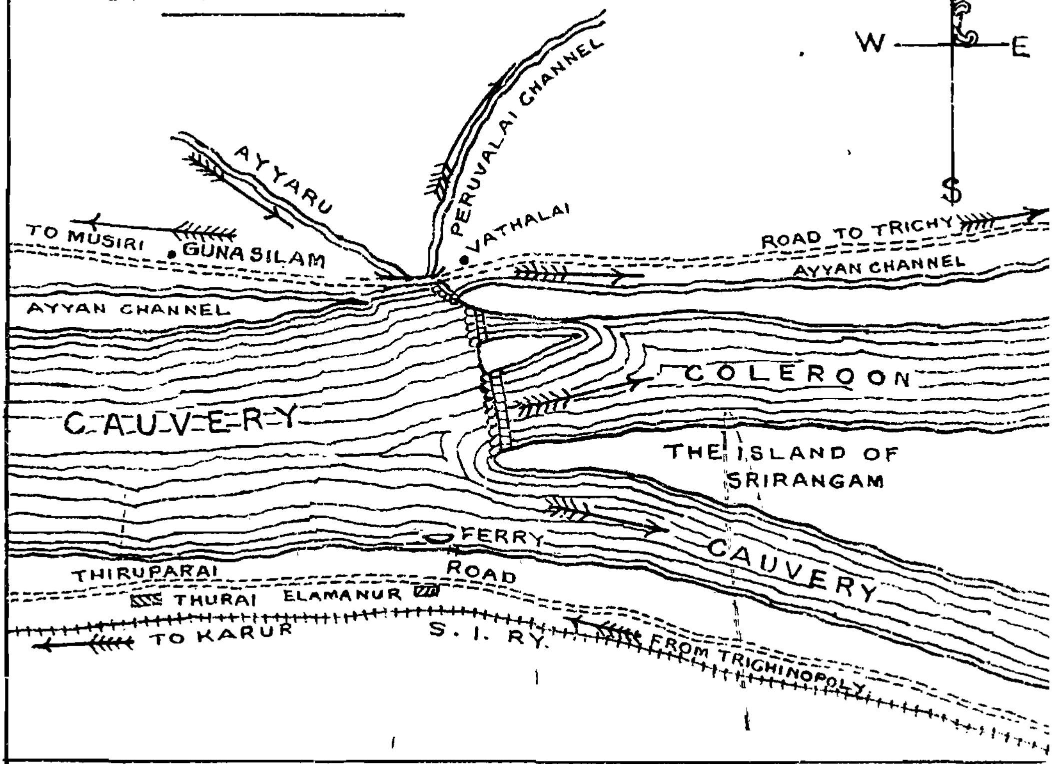
Irrigation is carried on in our district by canals, tanks and wells. Of the total irrigated lands in the district 46% is fed direct from river channels, 21% by tanks and 30% by wells. The most important channels are those under the Cauvery. Next in importance are those under the Coleroon, Nandiyar and Amaravathi. The Cauvery irrigates 1,19, 200 acres, the Coleroon 5200 acres the Nandiyar 3000 acres, and the Amaravathi 2400 acres, thus bringing the total to nearly 1,30,000 acres.

The *Upper Anicut*, 11 miles west of Trichinopoly near the Elamanoor Railway Station, was constructed across the head of the Coleroon during 1836-38 by Sir Arthur Cotton. The Coleroon flows at a lower level than the Cauvery and this dam was designed to prevent too much water from flowing down the Coleroon and to fill the Cauvery adequately. The Upper Anicut was remodelled during 1899-1904 at a cost of 6½ lakhs of rupees. It now consists of a bridge across the Coleroon of 55 bays of 40 ft. span each fitted with Colonel Smart's Counter-balanced lift shutters. Each shutter weighs 8 tons, but so arranged as to be easily raised by one man. The shutters when down hold up water to full-supply level in the Cauvery, while all water in excess of this, except in the highest floods, is let down the Coleroon. So the Coleroon serves the part of a safety valve for the Cauvery by raising the shutters to the required extent.

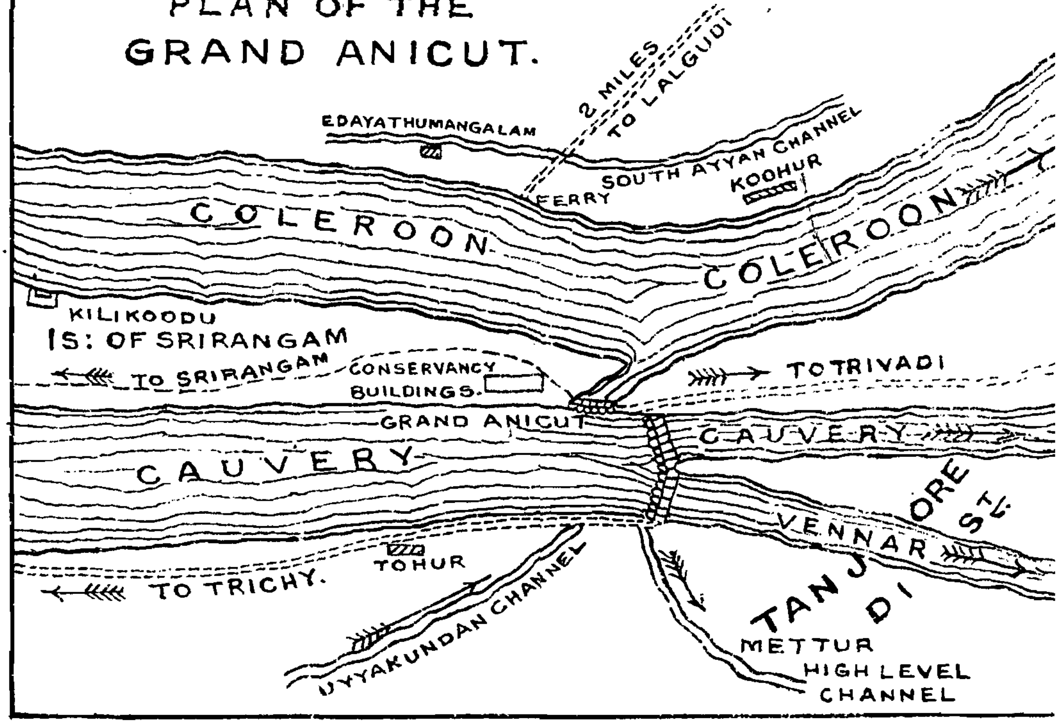
The *Grand Anicut* which is beyond the limits of this district, has much to do with the irrigation of the Tanjore District, but affect the Trichy District very little. The Upper and Grand Anicuts are designed chiefly to benefit the Tanjore District. The newly constructed Bed-regulator at Kattalai, the Pallapalayam Anicut across the Amaravathi in the Karur Taluk, and the dam across the Nandiyar in the Udayarpalayam Taluk are some of the other dams of importance in this district. These are in charge of the Public Works Department and they could feed respectively 19000, 3850, and 4959 acres.

Korambus (குரம்புகள்). Temporary dams called Korambus served the purpose of permanent dams on the river Cauvery,

PLAN OF THE UPPER ANICUT.



PLAN OF THE GRAND ANICUT.



IRRIGATION CANALS UNDER THE CAUVERY IN TRICHINOPOLY.

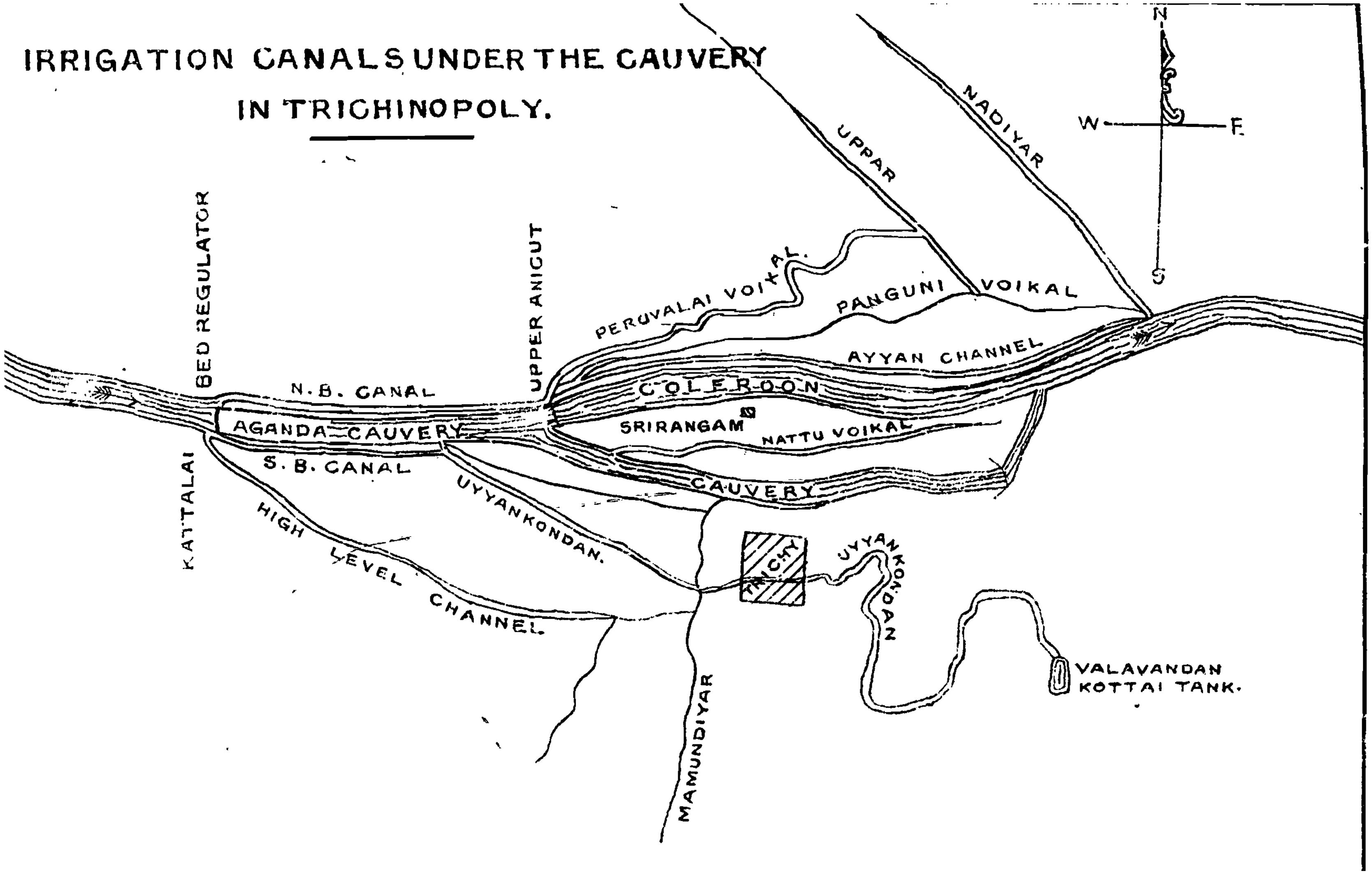
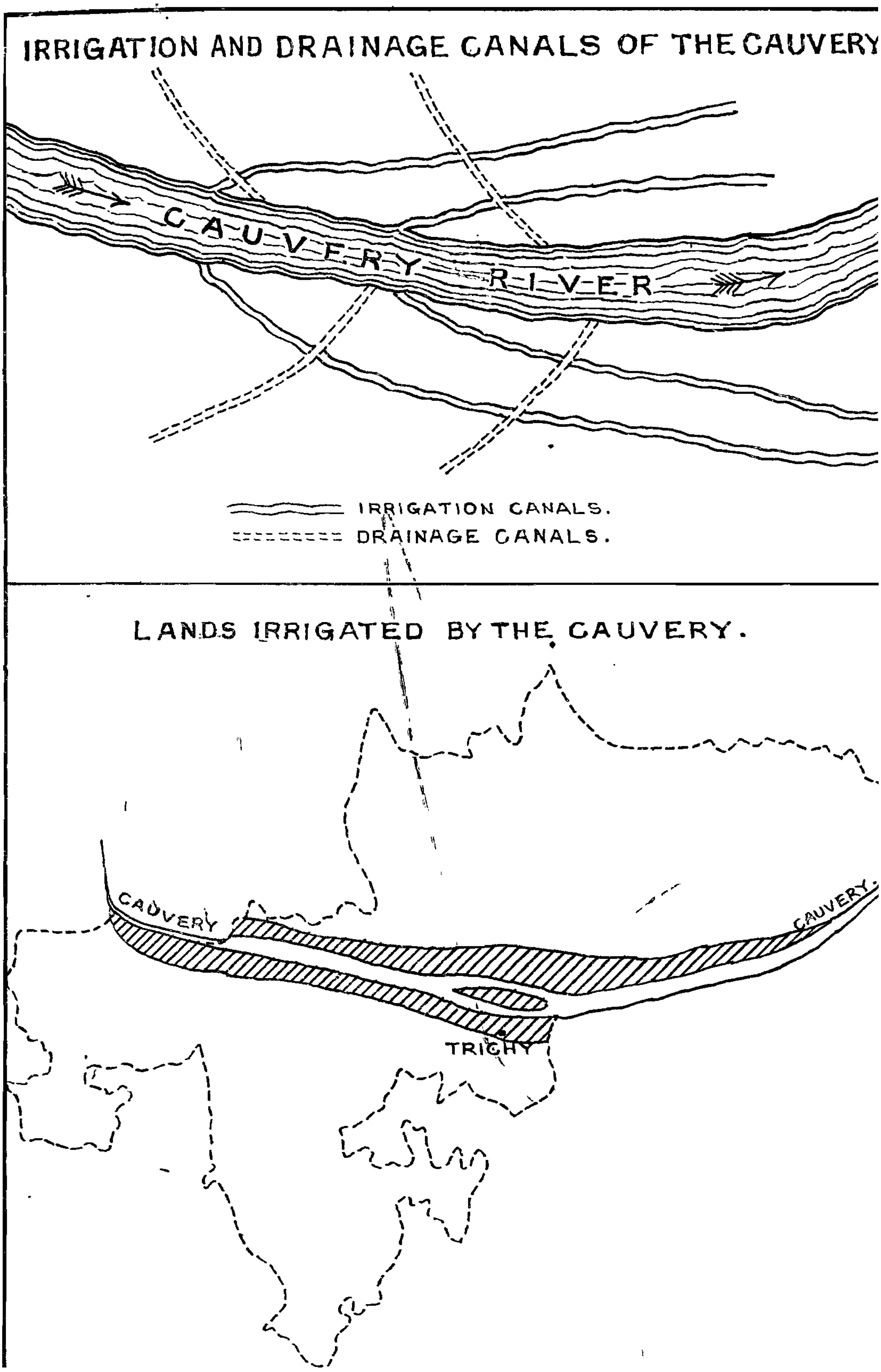


FIG. 24


IRRIGATION AND DRAINAGE CANALS OF THE CAUVERY
CAUVERY RIVER
IRRIGATION CANALS.
DRAINAGE CANALS.
LANDS IRRIGATED BY THE CAUVERY.
CAUVERY
CAUVERY
TRICHY

Coleroon and Amaravathi. These Korambus are constructed not in small rivers, where a cheap permanent dam may be constructed, but only in bigger ones with shifting sand and changing water course. These are generally made of sand, earth, branches, bamboos, bushes, and grass built from the head of the channels when the supply in the river falls low. Each fresh sweeps them away and they have to be renewed. They were not always put up in the same place, as the water-course of the river was constantly changing and the line of the dams had to be modified accordingly. Sometimes these Korambus were a mile long, required thousands of labourers to construct and divers to lay their deep foundations.

These Korambus were formerly built by the ryots themselves by customary labour. But in 1857 the customary labour was commuted into a cess known as " the voluntary irrigation cess," and was administered by the Revenue Officers. When the land assesment was increased in 1900, the cess was abolished, and the Government undertook to make an annual grant of Rs. 25,000 for the up-keep of the Korambus and the main channels belonging to that river. But the permanent Kattalai Bed-Regulator has now replaced all these Korambus in the Cauvery river.

The main irrigation channels of Trichinopoly are the Ayyan, the Peruvalai, the North Bank, the South Bank, the Uyyakondan and the High Level, the last one still under construction, all of them being under the Cauvery

List of Cauvery channels in the Trichinopoly division with their ayakats and the discharges at F. S. L. :—

Serial No.	Cauvery Right or Left Bank.	Name of Channel.	Ayakat in acres	Discharge of F. S. L. cusecs	Remarks.
1.	Right Bank.	Pugalur channel	2571	103	
2.	„	Vangal channel	1100	27·5	
3.	„	Nerur channel	1750	43·75	
4.	„	South Bank canal and Uyyakondan	40000	1000	
5.	„	High Level channel	19000	380	
6.	„	Ramavaithalai channel	1453	51	
7.	„	Poduvaithalai and Edavaithalai	2975	88	
8.	Left Bank	Kattuputhur channel including Govt. irrigation	3817	127	
9.	„	Thottiam Chinna Voikal			
10.	„	Musiri Mettu Voikal			
11.	„	Thottiam Peria Voikal			
12.	„	Sreenivanallur channel			
13.	„	Musiri Palla Voikal			
14.	„	Musiri Nattu Voikal Kattu Voikal, Korai Voikal	10400	260	Still under construction.
15.	„	Amur channel			
16.	„	Konaselam channel			
		Items 9 to 16 to be irrigated by the North Bank canal			
17.	„	Peruvalai channel	18439	400	
18.	„	Ayyan channel	14589	591	
19.	„	Sreerangam Nattur Voikal	2965	99	
			119059	3170	

The *Ayyan* and *Peruvalai* channels take off from the left bank of the river Cauvery just above the Upper-Anicut, the former runs almost parallel to and very near the Coleroon, while the latter diverges towards the North-east, both of them irrigating the southern part of the Lalgudi Taluk. The drainage of these channels is the *Panguni-voikal* which irrigates part of the Lalgudi Taluk.

The North and South Bank Canals. These canals take off from the left and right banks of the river Cauvery just above the Kattalai Bed-regulator. The regulator as we have already seen has taken the place of the Korambus built across the Cauvery at so many places. These canals are newly constructed very near and parallel to the main river. The smaller channels which were originally taking off from the Cauvery direct, are now taking off from the two canals which run parallel north and south of the main river. Thus the necessity of building the Korambus annually is not only obviated, but the supply to the channels also is made regular and satisfactory.

The *Uyyakondan channel* which is the longest and most important of all requires special consideration. The entire length of the channel is 43 miles. It was originally taking off from Pettavaithalai some 15 miles west of Trichinopoly Town through a head sluice. There was a leading channel from the Cauvery to this sluice. This is now abandoned. The South Bank canal now tails into the Uyyakondan just near the original head itself. After the connection of the South Bank canal with this, the irrigation under Uyyakondan especially at its tail end has been more satisfactory. The total extent of irrigation under this canal is 40,000 acres. The Uyyakondan has got both direct ayakat and tanks to be fed. Tanks are found only below mile 35½ near Tiruvarambur. This canal is a contour canal and so is having a zig-zag course and irrigates lands only on the left side. Altogether there are 14 tanks filled by this channel of which the following are some of the most important ones. 1. Kuthaparayakat 1040 acres, Sevandakulam 400 acres, Valavandankottai 600 acres. Finally the Uyyakondan empties itself into the Valavandankottai Tank which is situated to the north of the Tanjore road near mile 10. Before the South Bank canal was tailed into the Uyyakondan, supply to those tanks was unsatisfactory. A sort of turn-system (முறை ஜலம்) was followed and the last 5 tanks were completely omitted from this turn system. Now all the tanks are at least having one filling before August. There is also the possibility of raising a second crop under these tanks. Consequently revenue kist has also increased, for the quality of land has increased.

Investigations are being made to extend the Uyyakondan beyond Valavandankottai to the Tanjore District the proposed extension being 7 miles in length. About 2500 acres could thus be

brought under cultivation by this new extension. But the main purpose of the extension is to feed the tanks in the Tanjore District which are at present rainfed.

The High Level Channel. This owes its existence to the Mettur reservoir. With a reservoir at Mettur, and a Bed-regulator at Kattalai, it was thought easy to irrigate the barren high-level tracts to the south of the Cauvery river at a distance of 4 or 5 miles. Hence a new channel is being constructed which takes off just above the Kattalai Regulator. As this is intended to water lands in a higher level, this is carried at a higher level, hence the name High level channel. This channel tails into the Mamundiyar which in turn tails into the Uyyakondan some 2½ miles S. West of Trichy town. This new channel will water 19,000 acres of land mainly in the Kulitalai Taluk.

Tanks. There are 7 tanks irrigating 500 acres and more, 49 supplying 200 acres and 1558 with smaller ayakats in this district. The largest of these is the Kandratirtham Tank in the Udayarpalayam taluk which waters 1315 acres. All except the Cauvery-fed channels are rainfed. The former are filled thrice a year while the latter only twice. Tanks are mainly found in the Trichy Taluk. Tanks with an ayakat below 200 acres are under the Revenue Department while the others are under the supervision of the P.W.D.

Wells. Wells are chiefly found in the Karur and Musiri Taluks, and are rare in the Trichy and Udayarpalayam Taluks. Owing to their proximity to the hills the wells near Turaiyur and Perambalur have a better supply of water than those in other parts of the district.

The Soils and the Economic Products of the Trichinopoly District

By

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Natural divisions. Trichinopoly contains no well marked natural divisions. Two ranges of hills, the Pachamalais and the Kollimalai hills, rise and run along on the north of Perambalur and Musiri taluks. In the south and south-west, it is broken up with scattered rocky heights, rising into some prominent peaks on the Madura border. The district consists of an undulating plain, bisected by the valley of the Cauvery.

SOILS.

Geology. The soil of any place is primarily made up of the constituent elements of the disintegrating units beneath it, commonly known as the bed-rock.

The bed-rocks, in this district, are at different places of different age, of differently formed kinds, under diverse conditions. Consequently they themselves vary in the constituent elements in them. Geologically speaking, in this district there are in all, six kinds of rocks, as a result of which there are 6 kinds of soils.

These rocks are stratigraphically classified as (1) the archaean rocks of Karur, Kulitalai and Musiri, and the sedimentary rocks of (2) the Uttathur group, (3) the Trichinopoly group, (4) the Ariyalur group, (5) the Cuddalore recent sand-stone and (6) the alluviums of Cauvery and Vellar.

While the western half of the whole district, comprising of Karur, Kulitalai and Musiri, is occupied by the older archaean rocks, gneisses and granites, the eastern half of the northern division is occupied by sedimentary deposits, whereas the south-east corner of the district, in the eastern half of the southern division, is covered by a thin bed of low level conglomeratic laterites, by local denudation carved into miniature plateaus.

The soils-classification. The surface soils formed of these rocks differ considerably in their structure, and properties towards heat and moisture. They fall into three main classes namely, red, regar, alluvial. The areas of their distribution in the district are as follows: —

Name of the Taluk.	Per cent of Red Soil.	Per cent of Regar. Soil.	Per cent of Alluvial Soil.
Karur	100	..	..
Kulitali	93	3	4
Musiri	68	29	3
Udayarpalayam	49	51	..
Lalgudi and Trichy	45	31	24
Perambalur	19	81	..

Over the archaean rock-beds of Karur, Kulitalai and Musiri the red predominates. Over the sedimentary rocks in Udayarpalayam and Lalgudi cum Trichinopoly, they are equally divided between red and black ; whereas in Perambalur it is almost entirely one of black. Taking the district as a whole, the alluvial soil forms only about 5%. The colour of the flood waters of rivers draining these areas are true to their land of birth : Amaravathi, Koraipottanar, Ayyar and Mamundiyar wash down always red earth ; that tributary of Uppar, which drains the west of Perambalur and Uttathur, brings down saline waters, black earth and white limes curdling in them ; Nandiyar of southern Perambalur and entire Uttathur hurls down rolling waters, saltish, entirely white and highly impregnated with lime and soda salts and white clay. The Marudiar of north-east Perambalur and south-west Udayarpalayam carries down brackish waters, sometimes red and sometimes grey but always brackish.

Quality. Red soil is generally poor in quality: it is made up of gravels and shingles and red sand and earth ; the regar of Perambalur is largely of good quality, but the black soil of Udayarpalayam is poor, very sticky and devoid of humus. On the south of the Cauvery, the upland is covered by inferior soils, like the one on the north, chiefly made up of gravels, shingles and red sands and earth ; " on the east of it over wide tracts on the miniature plateaus already referred to, the earth is so impregnated with soda salts as to be almost entirely bare of vegetation."

Between these two big divisions of the district and lying along the borders of the Cauvery on both sides is the alluvium, mostly formed by the floods of the Amaravathi, the Noyil, the Bhavani and the Ayyar, and less by the Cauvery.

Again the same class of soil at different places vary very widely in its capacity to support plant life, and bear crops, according to the number and relative quantities of the soil elements they hold and the state they exist in at any particular locality. Each variety of such soils is called after the predominating element and property present in it. The chief of such varieties are as locally called:—

Tamil.	English name.
1. சரளைக்காடு (பொட்டல்)	1. Uncultivable gravel waste.
2. மணல் காடு	2. Sandy waste (Semi-desert) and uncultivable as such.
3. சரளை பூமி	3. Gravel soil, uncultivated but cultivable.
4. மணல் சாரி பூமி	4. Sandy loam.
5. செவ்வல் மண்	5. Red loam.
6. செம்மண் பூமி	6. Red earth unfit for cultivation.
7. கருங் காடு	7. Heavy regar soil.
8. கரு மண்	8. Black loam.
9. நத்தம் மண்	9. Black loam devoid of humus.
10. உப்பங் களர்	10. Soil impregnated with soda salts and unfit for cultivation at any time.
11. சுக்கான் பூமி	11. Soil with kankar predominating in it.
12. போதை மண். வண்டல் மண்	12. Alluvium, loam, rich in humus and essential minerals.

RAINFALL

Next to the soil the determinant of vegetation is rainfall. On drawing a line from the north-east corner of Udayarpalayam to the south-west corner of Karur the line of movement of the two monsoons—the truth is revealed that with every step down on this line the amount of annual rainfall also steps down. This line marks the path of the two monsoons at their height.

This broad belt of rainfall begins at Udayarpalayam with an annual fall of 40·43 inches, passes through Perambalur (39·24 inches) and Lalgudi-Trichinopoly (32·60 inches), traverses Musiri (34·05 inches) and Kulitalai (32·82 inches) and leaves off Karur with an amount of 25·55 inches only.

Again much more depends upon the seasonal distribution of this rain than upon the annual aggregate. The official statistics for those places are as follows: —

Taluk.	Dry. Jan. to Mar.	Hot. April to May.	Wet. South-west Monsoon. June to Aug.	Wet. North-east Sept. to Dec.
Karur ..	1·05	5·04	4·3	15·22
Kulitalai ..	1·57	4·90	6·84	19·55
Trichinopoly ..	1·45	4·70	6·72	20·26
Lalgudi ..	1·39	4·35	6·39	21·26
Musiri ..	1·80	5·57	6·78	21·10
Perambalur ..	1·84	4·95	8·60	23·85
Udayarpalayam ...	1·84	3·86	8·92	26·22

From the above we find that this amount of rain is fairly distributed throughout the year: that the season of sowing has the greatest, and the season of harvesting has the least, rainfall. The latter immediately and abruptly too follows the former, which is most significant. From July to March the duration of the two together is 9 to 9½ months, if a week before and a week after are included. This period is more than sufficient for any annual crop grown in this district. The season of hot weather from April to May succeeds and affords the necessary rest to the soil.

Thus the rain completes what the soil has begun; and the product is the vegetation. In South India, all people belonging to the agricultural class, at the time of sowing, never speak on the subject without personifying these: the soil is called the mother and the rain the father, to whom the mother is said to bear fruits—the various crops.

Temperature has a decisive part to play; but no details of it for the whole district are yet available except the one regularly taken at Trichinopoly.

THE AGRICULTURAL PRODUCTS

The agricultural products of this district are all raised upon about 25% of its entire area. These are the cereals, the pulses, the oil-seeds and other products. Chiefly they are :—Kambu, Thinai, Samai, Cholam; Varagu, Ragi, Rice; Yellow gram, Horse gram, black gram; Castor, Gingelly, groundnut; cotton, tobacco, sugar.

The areas of some of the most important of these for the year 1931, excluding the area cultivated in the zemin lands, are :—

Rice	..	2,50,000	acres.
Ground-nut	..	10,600	„
Gingelly	..	58,000	„
Cotton	..	25,000	„
Castor	..	19,000	„
Plantains	..	5,000	„
Tobacco	..	5,000	„

The rest are cultivated alone or with other crops mostly under rain-fed dry conditions.

DISTRIBUTION OF THE SOILS AND THE PLANTS

The value of any soil increases with the number and percentage of the soil ingredients and of the availability of the nutritive materials especially of phosphoric acid and potash, for immediate absorption.

Taking the soils, in the order of their age and formation, the first is the red ferruginous dry soil. The area of its occurrence is on and around the archaean rocks of the entire area of Karur, Kulitalai and greater part of Musiri. Nearer to the parent rock, it is all boulders, stones, pebbles, gravels, shingles and coarse sands, devoid of even red earth. Locally this is called gravel "pottal," where nothing grows, nor can be grown. Farther away where the soil is comparatively thick, the sands are admixed with ferruginous earth thus making a sandy loam or heavy loam. This is the place

where quartz crystals, white, red and black mica occur in small pieces in plenty imbedded and scattered beneath. According to the percentage of the soil ingredients present, these soils are variously called: but in all cases, Pottal signifies a desert or an approach to it; Kadu (காடு), waste; Bhumi (பூமி), soil; Maṇ (மண்) loam and alluvium.

The term "Kadu" or "Pottal" is suffixed to barren uncultivable waste land, Bhumi (பூமி) to cultivable waste that requires preliminary preparation, and Maṇ (மண்) to soils that are under, or immediately fit for, cultivation. The red earth soil is worse than pure black clay. It is always moist, never shrinks and cracks on drying but forms one entire hard mass, is chiefly composed of clay and oxides of iron; hence the red colour. On this also as on the first class no plant can grow for want of other minerals and humus. Over other soils alone, namely, gravel, sandy red loam and red loam cultivation is possible. These soils as has been already pointed out occur in areas of poor rainfall.

Now let us take the three westernmost taluks, namely, Karur, Kulittalai and Musiri, where the crops are raised almost as dry ones. The soils are poor; humus is not so plentiful as it is at other areas lower down. The climate is dry and bracing; the rainfall is poor. Hence, the condition is singularly favourable for the fixing of the atmospheric nitrogen to the soil by the nitrifying bacteria. Consequently, the crops mostly grown on these areas are just those that are classified as sulpho-proteids, and carbo-hydrates.

Karur.—This taluk is on the extreme west of the Trichinopoly district. The soil is poor, and its specific heat is low. The rain over it is poorest. Even between day and night there is wide range of temperature. At night, during certain months the low temperature of the soil helps to condense moisture from the air. This dew combined with periodical showers from the clouds is found sufficient for certain kinds of cereals, such as Kambu. By composition it belongs to those kinds of cereals containing more fat and less starch or sugar. During its growth rain does it more injury than dry weather. This is the crop that finds ideal conditions in Karur for its native growth, and it is the most popular crop, widely grown in that taluk at the end of the north-east monsoon in the cool months of November, December and January. "Kambu" is to the tropical zone what oats are to the temperate zone. Lower down and on a richer soil with a relatively greater

rainfall " Thinai " தினை and " Samai " சாமை belonging to the same species as " Kambu," are sown.

Still further east and north with a still richer soil the tract is admirably suited for Chillies, Gingelly, Cotton and Tobacco. These are commoner in this taluk than elsewhere in this district; and they are irrigated from wells. As the sub-soil water is brackish, being drawn from hornblendic rocks, it suits them well. Cotton is a plant that will " put up with considerable differences in soil, under diverse climatic conditions," and requires salt in the air or in the soil. Like Cotton, Chillies and Tobacco also need a dry climate and brackish water. Gingelly is the most important of the oil-seeds, and is most widely grown in this taluk than anywhere else in the district.

Kulittalai.—Kulittalai and Musiri have conditions which are quite different from those at Karur. These two taluks taken together have a wider range of climate and weather than any other taluk in the district. The east of Musiri is almost wet while the west of Kulittālai is always arid as that of Karur, of which it is the neighbour. Cholam is the most important crop in the dry region of Kulittalai—Musiri, for it requires greater moisture, but has a wider range of adaptability than " Kambu." Cholam has more protein and less fat but always sufficient starch. It is to the tropical zone what Barley is to the temperate zone.

Parallel with it, the most important of the oil-seeds is castor. The black soils occurring in this region are rich in humus, and phosphates and potash. Wherever this kind of soil exists in this region, pulses belonging to the order of phospho-proteids are widely prevalent. Of these Black gram is the most important, whereas in Karur pulses belonging to the order of sulpho-proteids only find favour in the soil. The most important of them is Yellow gram.

Musiri.—But Musiri is a tract of comparatively higher rainfall than Kulittalai. So unlike in the latter area more than one variety of dry crops can be grown in the former. Excluding the regar soil found in the east of this taluk, the kind of crops grown over the red soil of the west is similar to those found in Karur and Kulittalai. Kambu on the extreme north-west and north, Cholam a little lower and nearer to the south and the east, still further south and east Varahu and Ragi in times of scarcity or

uncertainty of water for irrigation from wells, tanks and rivers, and rice under the irrigation of the Cauvery water along the border of the river—are the chief crops of this taluk.

Excepting the cereals raised for food and sustenance, no crops of any economic value form the natural vegetation of this part of the district. But Karur taluk which strictly belongs to and has a striking resemblance to the arid region of Salem and Madura has a few of such exportable crops namely Gingelly, Cotton, Chillies, Horse gram and Yellow gram, and a little Turmeric and Tobacco. Red loam, irrigation from wells and the river Amaravathi, the quality of the sub-soil water, and the poor rainfall render these exports possible.

The dry crops of the three dry taluks can be tabulated as follows :—

	Cereals.	Pulses.	Fibre.	Oil-seeds.
Karur	Kambu	Horse, Yellow gram	Palmyra பனை	Gingelly
Kulittalai	Cholam	Horse, Black gram	Cotton புளிச்சை	Castor
Musiri	Cholam, Kambu Varagu, Ragi	Yellow gram	Cotton புளிச்சை	Castor

Trichinopoly—Lalgudi Taluks.—Lying between the taluks of Trichinopoly and Lalgudi, along the borders of the river Cauvery, and in a narrow belt fringing that river on either side, is the Cauvery alluvium. This soil is composed of the fine silt and humus brought down into the Cauvery by the floods of the small rivers on both sides of it. It is also intimately mixed up with clay, fine sand and grit, and fine granules of lime stones. This alluvium rests on a bed rock of fine sand, which in turn rests on another bed of coarse sand to a great depth, loose but compactly set without being cemented together.

This plain is a land of never-failing supply of continuously running irrigation water.

On this soil most of the plant food is available at and near the surface of the soil; and the deeper the soil the less is this plant food in it.

These are the ideal conditions demanded by the paddy plant; and in this warm humid region paddy alone is the natural and hence the only economic crop. More of this occurs in the Lalgudi taluk on the inner course of the Cauvery than in the Trichinopoly taluk on its outer curve. Rice to this region is what Wheat is to the temperate zone.

On strong black loam (a heavier kind of this alluvium and consequently demanding less of water than the paddy), the next widely grown plant is the Plantain. In composition, both the fruit of this plant and the rice are predominently of only one kind of carbo-hydrates, namely, starch. Like Paddy, the Plantain also is exported to other districts.

Higher up in this taluk and in Perambalur is found the black sandy loam, the specific heat of which is lower than that of the former two. As a result of this, the soil is very warm and tending towards dryness. This kind of soil is nearly equally divided between Lalgudi and Perambalur; it occurs along the south-eastern, the eastern and the northern borders of the Uttathur group of cretaceous rocks. This is the region of hot moist weather alternating with hot dry weather, and has salt in the soil. The bed-rock of this region belongs to the Trichinopoly group.

In this area, as everywhere else in the whole of Perambalur taluk "shell lime stones and still further north, regularly stratified alternations of sand, sandy clays and conglomerate and coral reefs form the bed rock. The surface soil of this area is black, classified as regar, and rich in humus. This soil, being derived from the disintegration of the basaltic rocks, is of great fertility. Soft nodules of kankar containing carbonate of lime in the proportion of 50 to 80% are scattered throughout it."

The plant best suited for this region is the Sugarcane and as a matter of fact this is exactly the region where the Sugarcane cultivation is at its highest in the district.

Outside this division of the district, the uplands on either side of the Cauvery form barren sandy wastes and red earth. In the Trichinopoly taluk, south of the Cauvery the upland is generally covered by inferior soils, chiefly of a gravelly or sandy nature; and over large tracts the earth is so impregnated with soda salts as to be almost entirely bare of vegetation. Over this wide tract

Nature's bounty is only in salt; under Government license the extraction of saltpetre from the saline nitrous soils is widely prevalent.

But Lalgudi on the north presents a different sight. Leaving the granite land traversing east to west through Irungalur, about 6 miles on the north from the Cauvery, the Trichinopoly rock thins out and the Uttathur group rises into prominence covering the rest of the taluk. The soil of this whole area is highly charged with lime—" one of lime stones formed in coral reefs, rich in fossils and of poor sand." Uppar and Nandyar drain this area. The soil washed down by these rivers is white clay and full of lime, which form into a white crust upon the stems and roots of plants. So neither water, nor the soil of the land of which it forms the drainage is fit for the cultivation of any crop. Still a kind of vegetation natural to this soil is the small stunted acacia trees, shrubs and bushes, with small leaves and full of thorns. These supply fuel to the neighbourhood.

Perambalur.—Crossing over this Uttathur summit to the other side on the north, one enters into the moist plains of Perambalur. It is the region of the second greatest rainfall in the district, gets precipitation of rain during the south-west monsoon also, and is situated in a hollow surrounded on all sides by the elevated grounds of Pachaimalais, Musiri, Uttathur and Udayarpalayam. This plain rests on the Trichinopoly group of rocks and has derived its soil from it. Hence it is one of black earth, the composition of which has already been given above.

About 81% of this soil in this taluk is black, and classified as regar, and contains less sand and more clay. It is of good quality being rich in lime, phosphates and humus; and its peculiar character is its remarkable tenacity of moisture.

Such a soil occupies in this district a region of double seasonal rainfall which is low, however, being a little below 40″. The climate is moderately humid, and the air is generally dampest in the latter half of October and driest in the latter half of April.

These conditions suit the growth of Cotton, which has found a natural home in the soil of Perambalur. This plant withdraws from the soil most of the important constituents, potash and phosphoric acid, which are present in it in an unlimited quantity.

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Salt is another important ingredient required for the production of good cotton; and though saline air is not available in Perambalur, the soil has some salt in it.

So we find that in Perambalur cotton has found its congenial home; and over the entire area it has extended its domain and is the only economic crop for this taluk.

Where the soil is a little sandy and not so sticky and heavy, sugar is grown: this is the next important crop in this taluk. For there it has the soil most suited to it, as we have already seen.

Udayarpalayam taluk.—This taluk is situated to the east of Perambalur. Stratigraphically its bed rocks belong to the tertiary group of unfossiliferous gritty recent Cuddalore sandstones.

Again, this bed is subdivided in the ascending order of occurrence, into the Ariyalur bed in the south, the Ninniyur and Sendurai bed—the intermediary bed in the series of cretaceous and tertiary systems—in the centre and the Udayarpalayam (Cuddalore) sandstones on the extreme north and north-east.

The Ariyalur bed is situated on the south-east of the place of that name along and on the south of the Maruthiyar river. The surface soil, over this area, is the same as that of Perambalur, except that here it is more sandy and less clayey; but in all essential soil elements it holds all that are present in Perambalur soil. Here in this taluk it is of light green colour, and easy to work, because of more sand.

Like Cotton and Sugarcane, Tobacco is another plant thriving best under identically the same conditions as those required for the first two crops.

This plant is grown in this area, along the banks of the Maruthiyar river, and on the south side of it also. The acreage under this crop is considerably large; and it is mostly situated in zamindary villages. Though the same plant is cultivated in Karur to a considerable extent, the quality of the produce is not the same in both; it varies with the soil. Excess of lime in the soil promotes quantity but weakens quality; while excess of clay produces a light, yellow leaf that is practically tasteless. The percentage of nicotine in the leaf is found also varied as a result of climatic difference. Hence the difference in the quantity and the

quality of the leaves produced at the two extremities of this district. The Karur produce contains a greater percenatge of nicotine, and consequently is of better quality; thus quality compensates for deficiency in quantity.

The Udayarpalayam soil makes its appearance and covers over nearly half and even more of that taluk. The surface soil is more sandy, red and ferruginous than anywhere else; and is of fair quality. The soil elements of lime, potash and phosphates, are easily available in large quantities for the plants to draw upon. These are present in the soil in such a state that they are liberated from their compounds so slowly and in such small quantities that practically nothing of them is wasted or washed away. These compounds, immense quantities of which in the shape of phosphatic nodules, are locked up at Uttathur bed, exist over this entire area in particles of small size and intimately intermixed with other soil elements.

This sub-region is perched higher up on the extreme north-east of this district. Towards the east it descends into the plains of the South Arcot district.

The average annual rainfall in this region is 42.16″, the heaviest in the district. During the months, July to November, the monthly rainfall is almost progressively increasing. Then receiving a check in December, it is systematically diminishing from then to the end of March.

Hence, many of the seed crops, grown in this district, not excluding rice, can be grown here as 'Manavari' or tank-fed crops. Under tank irrigation the chief crops are Rice, Ragi and Varagu. Cholam also is not uncommon.

Of all the dry crops raised in this wet region the Ground-nut is by far the most important. The red sandy loam, the systematically distributed rain, and the filtering down of water near and around the roots of cultivated plants thus keeping the soil always wet but not excessively moist, mealy and easily crumbling in character, constitute the ideal conditions for the cultivation of this kind of crop. Being a region of sufficient rainfall, among the cereals only such that require relatively more moisture than Kambu, Thinai, Samai and Cholam survive and live to bear produce. Hence, in common with Musiri, this taluk also is a tract

of mixed sowing. The object of such sowing is not so much to reap a bumper crop of them all, as to thin out the growth of vegetation, as a result of the survival of the fittest, and the different periods of time required by each to ripen.

In this region of sufficient rainfall and wet but not excessively moist soil, Ground-nut alone is the most economic crop. But the crop suffers in this taluk much by the uncertainty of seasonal rainfall.

To sum up : — (a) In the arid region of Karur, with its poor soils, on the extreme west of the district the dry crops are chiefly such of the sulpho-proteins among the pulses as Horse gram and Yellow gram, and Gingelly among the oil-seeds. The chief of the irrigated crops are Rice, Cotton, Chillies and Tobacco.

(b) In the dry region of Kulittalai taluk, Cholam among the cereals, Castor among the oil-seeds, and Black gram—the phospho-proteid kind—among the pulses, are characteristic crops.

(c) In the inadequate rainfall region of Musiri taluk, Cholam, Ragi and Rice, Yellow gram and Castor claim equally their place.

(d) In the irrigated alluvial plain of humid Lalgudi, Paddy and Plantains and Cocoanuts are the only economic plants.

(e) In the black cotton soil of damp Perambalur, Cotton and Sugar are the only economic products.

(f) In the black sandy soil of Ariyalur, Cotton and Tobacco are the chief crops.

(g) In the red sandy loam of wet Udayarpalayam Ground-nut is the only profitable crop.

THE FOREST PRODUCTS

The forest wealth of this district is as it should be, very poor indeed. The rapid alternation of heat and cold in the soil in the day and the quick and violent change of weather and wind, and the rapid variation of temperature in a year, make the life of any species of trees hard to exist.

Hence, only semi-desert vegetation such as acacia shrubs and stunted trees make their solitary appearance over vast areas in all taluks except Udayarpalayam. In Udayarpalayam, these grow a little closer together; and, at a distance, give some appearance of feeble solidarity.

Under each taluk, some extent of such wild undergrowths have been isolated, and constituted as a forest under reserve. The area of these reserve forests in each of the taluks is :—

Taluks.	Karur.	Kulittalai.	Musiri.	Trichy.	Lalgudi.	Udayar-palayam.	Peram-balur.
Areas sq. miles.	Nil	36·5	90·5	Nil	11·0	68·2	20·3

The kinds of vegetation growing in these forests fall into three distinct classes, namely,

(1) Those on the Padugais, along the big rivers and channels ;
(2) Those in the plains ; and
(3) Those on the hills.

Padugai forests.—These are the areas, along both sides of the Cauvery and enclosed by the flood banks and flooded annually. The trees are mostly planted ones. These Padugai reserves along the Cauvery and Coleroon, in Kulittalai, Trichy-Lalgudi, and Udayarpalayam taluks, are mostly of 'Kodukappuli,' 'Naval,' 'Vagai' and 'Babul' (Karuvai). They are of thick foliage and of gigantic growth. The leaves are used for Korumbus or sold out in auction for green manure by the Department.

These areas are necessarily limited and confined within the flood banks of the river. So they cannot support any species of animals, found wild in real tropical forests. But sometimes, as in the reserves of Kulittalai ordinary cows, bulls and calves are found grazing unclaimed.

Overwhelming in numbers are the monkeys, which make periodical raids into adjacent villages and do havoc and ruin to their crops in the fields. Their fondness for the cocoanuts spreads

terror into the neighbourhood and leaves desolation in their wake.

These forest growths serve well the purpose which they are intended for: they preserve the banks and the adjacent soil from being washed away by the floods.

Plain Reserves.—Under this head are grouped all those reserve areas, varying anything from a few hundreds of square yards in and around the tank beds to a few square miles of poor jungle growth in the open plains. These reserves in Kulittalai, Lalgudi, Musiri, Perambalur and Udayarpalayam exhibit a good deal of variety in their growth. Those in Lalgudi are either tank beds mostly covered with Babul or scrub jungle, full of Velvelam and of stunted growth. The insignificant reserve at Karur consists mostly of Palmyras; but contains also Velvelam and Vapam and Sithai. The Udayarpalayam upland reserves are also scrub jungles containing chiefly the Kasan tree, while the scrub reserves of Musiri and Perambalur have a somewhat better growth of Usilai, Velvelam, Babul, Sithai, Karungali and Vadatharai.

The economic products of these forests are the leaves of shrubs and the barks of plants and trees, widely used for the local tanning of hides and leather, and for dyeing. The latter art has become extinct, while the former is having a lingering death.

The larger trees are utilised for mote-wheels, carts and wheels, shed erection, house construction, and for fuel. A few people make their living by carting these fuel trees, either as such or converted into charcoal, to the alluvial plains on the south.

Vembu and Tamarind monopolise the dry red soils of Karur, Kulittalai and Musiri, and Ilupai and Vembu the plains of Perambalur and Udayarpalayam. These latter two taluks are noted for the supply of the oil and oil cakes of these two kinds of oil-bearing trees.

Hill Reserves.—The forests on hills present a different sight, have a variety of growth and usefulness and hence are more important.

The hill reserves afford protection to the head-waters of the streams whose sources lie in or close to them. In some of them a few valuable and useful trees grow and bring in revenue to the Government. The forests and the hills in the Kulittalai taluk con-

tain Sithai, Vembu, Usilai, Palai and Satin wood, besides other insignificant ones. In the Trichinopoly taluk there is no such reservation nor in the Lalgudi taluk.

In recent years 72.58 sq. miles of reserve forests have been handed over to and put under the management of panchayats, and the Padugai forests, under the Executive Engineer; and they are no longer now under the Government Forest Department.

The Kollimalais lie in the Namakkal taluk. The Pachaimalais alone are situated in this district on the north of the Perambalur taluk. A forest in the real sense of the term is found on those hills, at an elevation of about 1,500 feet above the sea-level. Even this is broken into patches by the intervening cultivated spaces of the native hillmen, the "Malayalees."

Of the trees growing therein the Bamboo is the only valuable timber plant. The rains of the south-west and the north-east monsoons and quartz and silica of the rocks make this kind of grass species grow luxuriantly all over. The element silicon is the essential constituent of the hard bark on the Bamboos; where this is not available to them they are found not thriving so well. Hence they mostly abound on the hills or in the sandy alluvium over the plains.

The local source of this essential material being evidently small, being confined either to the hills or the alluvial plains, the whole district is apparently dependent on the supply of this from the Pachaimalais. The Forest Department disposes of this produce in those areas under "the system of five years growth," and realises a considerable amount by such sales.

The Crops of the Trichinopoly District.

By

Mr. A. S. Rajamanickam, M.A., Dip. Econ.

After a study of the physical factors of Agricultural Geography in the earlier papers, let us now take up the all important study of the crops of the district. In this district, as in the case of some other southern districts, we are struck by the great variety of crops raised season after season.

There are different species of paddy grown in this district. They come under two main genera; namely Samba or Pisanum and Kar. The Samba takes five to six months to mature and the Kar three to four months. Samba is generally sown as a single crop and is sown in July and August and harvested in December, and January. If it is cultivated as a second crop it is sown in October and November and harvested in March or April. It is generally transplanted from seed-beds but sometimes sown also broadcast. Valan, Pisanum, and Vangi are the chief species of the genus Samba and Vellai and Mattai Kar are the chief species of the genus Kar. "The Kar sorts are generally sown broadcast."

With regard to irrigated paddy sowing is done in different seasons in different parts of the district. Generally, only one crop which belongs to the Samba genus is raised each year. The early and late season crops are the Kuruvai and the Samba respectively: the former sown in parts of Trichinopoly and the uplands of Musiri in Chittrai and the latter in Purattasi i.e., September-October. In Kulittalai and Musiri Taluks, with the help of Cauvery channels, the ryots grow two slowly-maturing crops, of the Samba genus; the first in Masi (February-March) and the second in Adi (July-August). The Trichinopoly and Karur ryots, living in the parts watered by Cauvery, follow a scheme of five paddy crops lasting for two years. The ryots in the padugai lands, along the banks of the Cauvery in Karur, also follow this system.

In the Trichinopoly district paddy is also grown as a dry crop. It is chiefly done so in the Udayarpalayam Taluk. It is also com-

mon in the southern parts of Kulittalai, on the tank beds in the east of Perambalur and by the sides of jungle streams. The ryots usually choose only slowly-maturing variety. After the early showers in Chittrai i.e., April to May the ryots plough the land deeply two to six times. The first rains come in Adi and the seeds are sown broadcast. In the taluk of Perambalur paddy is mixed with Kambu in the proportion of 1 : 2.

Rotation and mixed sowing in the district.—Just a word about the rotation and mixed sowing of wet and dry crops in this district. The ryots of the Trichinopoly district are well aware of the advantages of rotation, which they call " as changing the leg."

By changing the varieties of paddy grown, the ryots of this district seem to think that they are giving their lands a kind of rest. Nellore Samba is one of the varieties imported for this purpose. Under wet cultivation they follow the following rotation. After a plantain crop, which remains on the ground for three years, paddy is continued before the plantains are grown again. Betel, which is also a three-year crop is not grown again on the same spot, if it is not followed by paddy at least for two years. Another system is that Betel follows paddy, which is followed by sugarcane, which is not allowed to remain more than a year in this district. Then paddy follows again for at least three to five years. Sometimes paddy follows turmeric for at least two years.

The ryots of the district generally have a dry crop immediately after the wet, if it is the only one for the year. Generally, gingelly, occasionally mixed with Indigo, is chosen for the purpose. The practice of the ryots in the taluks of Trichy and Perambalur is to sow Cholam or Kambu or Ragi immediately after the wet crop. A general custom is to grow the dry crop in May and June and the paddy in the following October or November. Sometimes a dry crop is raised before and after the principal paddy crop. This custom is very much in vogue in Perambalur, where the wells are particularly good. It is interesting to note that in the Trichinopoly Taluk, where the ryots raise two paddy crops, the custom is to raise a crop of vayal-payaru in March or April occasionally mixed with Indigo.

Under dry cultivation the plans of rotation are the following : Varagu is followed by horse-gram, Kambu by ragi in alternate years.

With regard to mixed sowing the interesting custom is, if Kambu is grown on the same field year after year, to mix the same with other crops which should be different every year. To some extent mixed sowing takes the place of regular rotation. It is customary in 'Manavarai' cultivation and to a certain extent in garden cultivation, to grow mixed crop in the same field. The ryots are of opinion that "whatever the character of the season may be, it will almost suit one or more of the crops in the mixture and that if a quick-growing and a slowly-maturing crop are mixed, space is economised, since the former is off the ground before the latter has begun to spread." Ragi which is abundantly grown in Musiri and Perambalur taluks is generally mixed with Samai, Tenai and Black-gram; Kambu with ground-nut, Indigo and yellow-gram; Cholam with gingelly and gingelly with yellow-gram. The idea underlying this kind of mixed-sowing is to mix the exhausting crops with those that collect Nitrogen.

Kambu, Cholam and Varagu are extensively grown in this district. The area under Kambu is slightly higher than that under Cholam, nearly 2,80,000 acres and 2,61,000 acres respectively. Salem has the largest acreage under Kambu in the Presidency, nearly 3,94,000 acres and the area in Trichy district is nearly 32 times that of Tanjore which is mainly a rice producing district. Ragi covers nearly 76,000 acres which is roughly one-fourth of the area under Kambu and is ninth in the Presidency. Karur has more than one-third of the area under Kambu in the district. Cholam is extensively grown in Kulittalai and Musuri Taluks. Among the southern districts Trichinopoly stands second with regard to Ragi, while Vizagapatam has the largest acreage. Varagu, though thought to be the lowest in the scale of food grains is grown extensively in Udayarpalayam and Perambalur Taluks. It is needless to stress the importance of these crops for man and beast of this district, especially for the latter which gets ample fodder from these crops.

The important *money crops* of this district are groundnut and sugarcane. Others of minor importance are gingelly, condiments, including chillies, castor, cotton and tobacco.

Roughly 106,000 acres are under ground-nut (both irrigated and un-irrigated). South Arcot produces the largest quantity of ground-nut in the Presidency, area being 4,59,000 acres. Trichinopoly stands fifth. Ground-nut is gradually gaining ground and

has established itself as a major money crop of the district. Karur and Udayarpalayam have more than half of the area under groundnut in the district. There are many imported varieties found in this district.

Sugarcane is the second great money crop and is gradually rising to prominence. The area occupied by this crop in 1930-31 is roughly 8,000 acres, which is the third largest area among the Tamil districts. Vizagapatam has the largest area under canes, for the Presidency, roughly 34,000 acres, while Nellore and Kistna have the lowest production. Compared to Madura, Trichy is somewhat ideally suited for canes. Its soil and climatic conditions, added to the excellent drainage facilities, have contributed very much to the rapid growth of cane cultivation in this district. It is true that the ryots of this district, as in the other districts, are terribly hard hit by the universal depression and the consequent phenomenal fall in commodity prices ; yet under normal conditions it is really worth their while to bestow much thought and attention to improve and expand the cultivation of this crop for which the district offers excellent facilities.

Cotton is another money crop which occupies roughly 38,000 acres, (both irrigated and unirrigated). Bellary is the greatest cotton producing district in the Presidency, having an acreage of 4,78,000 acres. Among the Tamil districts Trichy stands sixth. More than one-third of the area under cotton lies in the taluks of Karur and Udayarpalayam.

Gingelly is another money crop of less importance, which is produced considerably in this district. More than half the area under gingelly is found in Karur taluk. The area under gingelly for the whole district is 50,000 acres, while Vizagapatam has the largest acreage under gingelly for the Presidency, and Trichinopoly occupies the fourth place. Among the Tamil districts Trichinopoly and Salem have almost the same area under gingelly, while Madura has the lowest.

Chillies and other condiments and spices occupy 21,500 acres of which chillies alone occupy 9,000 acres. This is more than two per cent of the total crop area and more than half of this lies in Perambalur and Udayarpalayam taluks. Guntur has the largest area under chillies (70,000 acres) while Coimbatore has the largest among the Tamil districts (11,000).

Tobacco and other drugs and narcotics occupy roughly 6,400 acres, of which tobacco alone occupies nearly 5,000 acres. This area under tobacco is just third among the Tamil districts, Coimbatore and Madura having roughly 41,000 acres and 11,000 acres respectively. Guntur again, as in the case of chillies, is the greatest tobacco producing district in the Presidency, the area being 65,000 acres. This crop is generally raised on a few favoured parts on garden lands. A rich alluvial soil and a careful and regulated use of brackish water are two of the essential conditions for the successful raising of this crop. For manure the ryots generally use the droppings of cattle penned on their lands, oil cakes, indigo, refuse, etc. Fish manure is being tried in Musiri and Lalgudi taluks in recent years.

There is a fairly decent area under castor. Trichy is the third large castor producing district among the Tamil districts (area roughly 8,300 acres). Anantapur is the largest castor producing district in the Presidency, and Salem leads among the Tamil districts (area 203,000 acres). The commercial future of this crop is gradually being assured. The future Eri silk industry of the Madras Presidency and the steadily increasing demand for the castro-lubricating oil depend very much on the successful cultivation of this important crop.

FRUIT TREES AND VEGETABLES

The friable, red ferruginous soil of the district is tolerably conducive to the growing of fruit trees, vegetables and other root crops, which occupy about 23,000 acres. Of these mangoes and plantains occupy about 2,500 and 10,100 acres respectively. The remaining area, about 10,100 acres, is occupied by other fruit trees and vegetables including root crops. Compared to other districts, the area occupied by mangoes is quite insignificant; nor is this district famous for any particularly good quality; but in Pudukottai, somewhat good graft trees and tolerable country varieties are found.

As regards plantains, Trichy is the fourth largest plantain producing district in the Presidency while Malabar with an area of 51,000 acres stands first. A large number of varieties is grown in this district, the famous among them being Rajavalai, Peyan, Rasthali, etc. Pachai (green) and Sevval (red) varieties also are common. The most delicious of all the varieties grown in the

district is the Rajavalai variety and is generally planted in betel gardens. The hill variety which is very famous in the Madura district is not to be found here. In this district the soil and irrigation facilities are good for the cultivation of this crop. The cultivation season commences in March or April. The profit out of this crop is considerable and it has added considerably, as the groundnut crop, to the economic well-being of the ryots of this district.

The human factor.—Before concluding, we should pause for a moment to discuss the human factor which is so very essential for determining the productivity and yield of a particular region. " The man behind the plough " is the pivot of all agricultural activities. The quality and the yield of the crops raised in this district, as in the case of other regions depend, more than anything else, on the skill, industry, patience, and prudence of the tillers of the soil. The Trichy ryots are not lacking in their practical knowledge of their work, though a majority of them are not aware of the advantages of the modern and efficient implements, highly-developed system of seed selection and the modern manuring processes. Thanks to the useful and highly instructive work done by the Madras Agricultural Department in this district, the ryots are gradually being acquainted with these important things. Already many bigger ryots are following their sound advice and instructions, out of the knowledge got from their patient and laborious researches in the various branches of the science of agriculture.

A Model of Intensive Cultivation in the Cauvery Valley

By

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It is commonly assumed by a school of geographers, the "climate philosophers," that native agriculture in the tropics, particularly in a rich river valley, would be indifferent and slovenly; because man there is not goaded to put forth much effort to gain his subsistence, as nature with her alluvial soil and abundance of water responds readily to the slight effort that is alone needed for subsistence on a low standard. People in a warm and moist climate are said to be neither inclined to, nor capable of, much exertion and cultivation can by no means be intensive. And of the variety of crops in the tropics, the banana, or the plantain as we call it, is selected as the typically tropical crop that requires the least effort but provides the largest quantity of food per acre and per worker.[1]

1. "Both Mexicans and Peruvians lived to a great extent on the banana; a vegetable whose reproductive powers are so extraordinary, that nothing but the precise and unimpeachable testimony of which we are possessed could make them at all credible . . . it is an article of primary importance for the subsistence of man whenever the temperature passes a certain point. Of its nutritive powers it is enough to say that an acre sown with it will support more than 50 persons; whereas the same amount of land sown with wheat in Europe will only support two persons."—Buckle in the first volume of his *History of Civilization in England* (World's Classics, pp. 81-82).

"The cocoanut and banana furnish food with practically no work."—Huntington and Cushing, *Principles of Human Geography*, p. 281.

"The banana is almost without a peer among nature's gifts to man. Wheat, corn, rice and potato are produced by arduous labour and tillage of the soil; but if the root of a banana tree is thrust into favourable tropical earth and nearby rival plants are given a few blows with the machete to keep the young banana plant from being overgrown, in a few months it gives its great gift of fruit. For years thereafter the shoots which the original plant sends up continue to furnish food throughout most of the year. . . . The amount of food produced per acre is greater than that of any of our favourite

A close study, however, of plantain cultivation as it has been actually carried on in the Cauvery valley in the Trichinopoly District in many villages on either bank of the river, of some of which the writer has an intimate knowledge, would serve to illustrate the injury done to our people and to the study of human geography by such *a priori* and sweeping generalisations. We would indeed find in the plantain garden, where it is raised as a commercial crop and not for home consumption, the acme of intensive cultivation among the field crops in this region, judged by the heavy outlay of capital and labour involved, while the powers of organisation needed for the management of the garden and the marketing of this perishable crop are developed to an unusual degree. The plantain belongs to the category of crops in tropics which had been growing wild in the past but have been latterly subjected to intensive cultivation and regular harvesting.

Plantains, grown on a large commercial scale for export, are confined to the villages with wet lands irrigated by channels taking off from the Cauvery. While most of the district is *kadarambam* or dry tract, it is on a thin green lining of *neerarambam* or wet area on the margins of the river and its channels that one finds the plantain interspersed with paddy or occasionally with two other intensively cultivated crops, betel and sugarcane. The Trichinopoly District has the third largest area under plantain, of all districts in the Madras Presidency. It is next to paddy the most important wet crop in the district. The Ordinance Survey maps seem to ignore the plantain on wet lands under the smaller channels. The Season and Crop Report does not give us details of the distribution of the crop in the various taluks. From the latest Resettlement Report (1926) of the district which has talukwar

bread grains . . . more than any other plant, the banana helps to make life easy in the tropics. It corresponds to the potato of the North European peasant and the rice of the Southern Chinese."—J. R. Smith, *The World's Food Resources*, pp. 163, 164.

"The banana is the most prolific of all the food plants known. . . . There is perhaps no tropical plant easier of cultivation than the banana."—H. A. Nicholls, *Text-book of Tripical Agriculture*, pp. 223 and 231.

"The plantain has been called 'the curse of the tropics' since it encourages idleness. . . . There is a common saying in Northern India that one who can raise 360 plantain trees of his own may live comfortably all his life. . . . The plantain is a 'kamadenu' to the men of rural India."—J. Kenny, *Intensive Farming in India*, pp. 595 and 598.

figures, we learn that Trichinopoly taluk, with the best consuming centres and the best transport facilities, has the largest area under plantain; Kulittalai, Musiri and Lalgudi follow in order while the other taluks have negligible areas. Villages on the southern bank of the river have the great advantage of being served by the South Indian Railway whose stations on this branch (the Trichy-Erode line) are remarkably numerous, there being a station for every two miles on an average. Villages on the northern bank are not deterred, however, by the extraordinary difficulty of having to send their crop across the river—which broadens out most at this stage of its whole course; they have the compensation of better irrigation facilities, the lands on the northern bank being on a lower level than those on the south. They have besides a number of smaller markets further north which they reach by the country cart, though they rely on the railway on the other side of the river for disposing of the major part of their crop.

The rich, alluvial soil, dark and loamy, is preferred for plantain cultivation; it might be a little more gravelly rather than clayey, for this would interfere with drainage. The water-requirements of the quickly growing and bulky plantain are very high; it is rotated with paddy on wet lands with an unfailing supply of water from irrigation channels, the rainfall alone being insufficient and ill-distributed. But the paddy fields which are likely to turn swampy in the rainy season cannot bear a plantain crop as this does not tolerate stagnation of water at the roots. Large quantities of water impounded in the trenches dug by the side of each row of plantains have to be let out regularly, for which drainage facilities are quite essential.

The plantain is an essentially tropical plant and is a lover of warmth as well as moisture; but the extreme heat of the sun before the advent of the south-west monsoon kills generally 10 per cent. of the young plants, 3 to 4 months old, though watering by hand from the trenches nearby is often resorted to. The damaged ones are replaced by big suckers. The havoc wrought by the south-west monsoon is not very great, if the plants are less than six months old; but in the case of trees which would come to fruition in June to August, if a different planting season had been adopted, the danger is greater and is not fully guarded against by propping the bearing trees with bamboo poles. This is, however, a necessary operation even in the case of plantains which come to bearing earlier in the year as the bunches are often too heavy for

the so-called stems to support in summer. Half the number of trees requires this propping by bamboos at any one time; and the planter must be ready with 400 to 500 bamboos per acre, if he wishes to minimise losses.

In most parts of the district a plantain garden is not kept on for more than two years together, during which two crops can be had, though three crops in a period of 2¾ years were common in the past and even now may be met with on some of the first class soils. But in no case in this district do we find the practice, said to be all too common in West Indies and other tropical lands, of keeping a plantain garden with successive ratoon crops for a number of years, 10 to 30. Perhaps this is possible only on virgin soils or on soils which regularly receive river silt as in some of our own deltaic districts. Neither of these conditions obtains in the Trichinopoly district, and hence plantain is rotated with paddy at the end of 2 or 3 years and this makes a world of difference in the labour and cost of production between our district and the countries from whose conditions generalisations have been most frequently drawn.

The labour that is demanded in the cultivation of plantains in our tract is indeed prodigious compared with that involved in the case of paddy or of any other intensively cultivated crop except sugarcane. The first operation is the digging of trenches for drainage all round the field soon after paddy harvest. Ploughing is dispensed with but the spade-digging of lumps of hard soil is not less effective; every foot of ground is tackled by the spade while the same cannot be vouchsafed in the case of our ploughs unless repeated several times. 20 men's labour of 4 or 5 hours per day, costing Rs. 15 per acre, is not less costly than a thorough ploughing of the field by old methods. The planting of young suckers at the rate of 900 per acre can be done by a few women labourers. The next most important item of labour is the digging of trenches by the side of each row of young plants a few days after they have come up, and this takes about 20 men working 4 or 5 hours a day and costs Rs. 15 per acre. The trenches are at first narrow and shallow and it is a fine art indeed to dig them deeper but not broader later on with the same spade; this costs an additional Rs. 6. The spreading out of the soil dug up between the plants costs another Rs. 10 or 12. On days of extreme heat or scarcity of water, special arrangements are made to water the young plants by hand from the trenches; even then some plants wither away.

The cost of watering and the cost of replacing suckers would amount to Rs. 15. Then follow another deepening of the trenches and levelling up of the soil above, both of which cost Rs. 10. Hand-hoeing and application of manure come next. The trenches have to be frequently (5 or 6 times at least) cleared of mud. Removal of the superfluous young suckers that shoot up round the parent plant, tying up of the leaves against havoc by wind and heat are minor operations but needing almost constant attention on the part of the planter or his trusted agent.

This is so far as the first crop is concerned, whose harvest begins 11 or 12 months after planting and goes on for about 2 months, the trees yielding not all at the same time, due perhaps to their different location, and the degree of sunlight and personal attention received. The cost of the labour of harvesting and of transporting the produce to the cart on the roadside devolves not on the planter but on the buyer, except when occasionally the planter himself chooses to send the produce for sale on his own account in the weekly markets or *shandies* nearby. The second crop is harvested at the close of the second year, 8 or 9 months after the first crop harvest is over; and in the process of its growth the main items of cost of cultivation are manuring, clearing of earth in the trenches, some hoeing, removal of surplus suckers and propping up the bearing trees. On the whole it does not cost more than a third of the cost of the first crop. As already stated, a third crop is getting to be rarer, after the advent of the *Puvan* which is the most prolific variety and hence commercially the most paying. And even where it is raised, the third crop costs about as much as the second crop.

In a normal plantation of two crops of plantains there is ample scope for labour throughout the two years practically continuously. Few indeed are the idle days—perhaps in the heavy rains where no work is possible on the sticky field. Hired labour has to be engaged for the variety of operations detailed above; and it is impossible for any planter to attend to more than a few items himself. So that it cannot be a mere family-farm. The village itself is seldom able to supply all the labourers needed and when work on plantains does not coincide with necessary work on paddy or millet fields, a host of labourers are attracted to the plantain area from the surrounding villages upland. In the villages famous for plantains, there is no tendency for population to fall; it shows a decided increase.

If the requirements of labour are very high, the demand for capital in addition to what is needed for payment of wages is also quite great. The wages bill alone in two years exclusive of the cost of harvesting, would amount to Rs. 125 but the other items of capital cost at least another Rs. 125. In the first place young suckers have to be purchased—about 900 per acre—at a cost of Rs. 30. Manuring with ground-nut cake, and in recent times with artificial fertilisers, is done at a cost of Rs. 80 to Rs. 100 in the two years. The use of pig dung has long been in vogue in plantain gardens in the Trichinopoly district—all which shows the uncommon enterprising spirit of plantain gardeners and their singular freedom from prejudice in the midst of conservative agriculturists. Propping by bamboo poles at the rate of 500 or 600 per acre costs another Rs. 100, though the poles can be disposed of after two years at a loss of Rs. 25. Plantain cultivation thus entails a lot of expenditure, generally from Rs. 250 to Rs. 300 per acre, which is not within the means of most cultivators even if some of them had the courage or capacity to carry on plantain growing; and this has led to distinct specialisation.

There are a dozen planters or more in every important village growing plantains who each take up on lease 15 or 20 acres for cultivation and there are a few who take up even 50 to 60 acres each. As wages have to be paid every week, and there are several items of purchase, one succeeding the other, like suckers, manures and bamboos, the need for ready money is quite great. Few indeed are owner-cultivators, at any rate such men cultivate one or two acres apiece and cannot make much headway. The more common practice is for the lands to be leased to some enterprising men with capital, partly owned and partly borrowed, and of great capacity for superintendence of work on the gardens and for bargaining with the buyers who are agents of firms in Madras and other big consuming centres. So keen is the demand for plantain cultivation that it is a common practice to pay down the lease amount for two years—which used to vary from Rs. 400 to Rs. 500 per acre before the days of depression—to the owner in advance even before land was taken up for cultivation, or to execute a pro-note for the amount at 9 to 12 per cent interest repayable when the two crops are harvested.

Such a high rate of rent is possible only where there is the prospect of a good yield and a ready sale. The very careful and efficient methods of cultivation practised in this area, unless counteracted by high winds or severe drought assure a bumper crop,

especially after the prolific *puvan* has displaced the more famous *rasthali* and other varieties which are poor yielders, and are unremunerative except near great consuming centres.

The ubiquitous *puvan,* though it has the reputation for being a good fruit for dessert after meals, does not always have a fine flavour or a pleasant taste. It is somewhat sour and thready, and in the villages that grow this variety in abundance, it is not considered much of a delicacy ; it is treated as a " thing edible but not worth eating ; " it is mostly grown as a money crop for export to big centres, where there is a large demand particularly in the marriage season and on festive and ceremonial occasions. Here we come against the common old notion that in the tropics people consume the plantain as a staple food, that it contains more nutrition than even cereals. It has no doubt in superabundance one important element of a proper diet, carbohydrate, which is an energy food, but used by itself to any considerable degree, without any addition of proteid foods it is apt to upset the stomach badly as all Indians know only too well. The tendency to overeat plantain fruit is no doubt not rare ; but it is a mark of poverty ; it is a cheap stomach-filling food, just as potato, the famine food, was in Ireland and elsewhere. We wonder whether in any part of the world, banana or plantain is the staple food of people, whatever geographers and others might say.[2]

There is, however, a great case for the use of plantains as a dessert after meals not only in our country but in cooler climates where some varieties of banana, particularly from Jamaica and other West India Islands are finding increasing favour. There is no reason why some of our more delicious varieties should not be introduced in the west, in the improved conditions of transport. The plantain has some commercial merits " in its method of ripening off the stock, and in its thick skin which is germ proof and

2. " More than any other plant, the banana helps to make life easy in the tropics. In parts of the Congo Basin and other humid portions of Central Africa, where the climate is bad for the white man, the nutritious banana is said to be main article of diet for many, probably scores of millions, of the negro race."—J. R. Smith, *Food Resources of the World,* p. 164.

" The fruit of the plantain supplies food for multitudes of people, indeed it is " to the inhabitants of torrid zone what bread and potatoes are to those of the north temperate zone." It has been said that a pound of plantains contains " more nutriment than 3 pounds of meat, whilst as food it is, in every sense, superior to the best wheaten bread."—H. A. Nicholls, *Text-book of Tropical Agriculture,* p. 223.

which makes it one of the safest and cleanest of fruits to eat, being in this respect superior to the apple, peach or pear"—we may add mango, orange, etc., which are not besides provided with the same nature's hermetical sealing as the plantain is. But it is doubtful if without cold storage all varieties can bear transport for two weeks or more through different climatic regions.

Already the problems of transport within the country are serious enough in the case of a bulky and perishable article like plantain and their solution deserves first attention. Apart from the common damage to fruits by rough handling at the points of despatch and of delivery and in some cases at intermediate transhipping stations, where there is a break of bulk due to difference in gauges of connected railways, the least delay due to unforeseen accidents like a breach of railway lines due to sudden floods, or a strike by railway employees, causes great damage to the merchant, which is soon shifted on the planter who is hit much harder than the grower of cereals who can wait and sell. Fortunately the losses are not so severe for people in our district as they have alternative railway routes to the north, where lie most of the markets, by two different companies, one running along the coast and the two others in the interior. The more difficult part of the transport in the case of villages lying on the north bank of the river lies much nearer home, in the effort to cross the river, which is in many places a mile broad and has varying degrees of shifting sand and shallow water surface to be tackled by bullock carts. The construction of causeways, if not *pucca* bridges, at the more important crossing centres will very greatly facilitate the transport of plantain to railway stations and reduce the ultimate burden on growers. Or else the motor lorry is more likely to rob the railways of a good portion of their traffic. We are told that an attempt has already been made in this direction.

We find in the accounts on banana that it forms the basis of a few food products that can be preserved and consumed at leisure. The ripe fruit is canned and preserved as a jelly or jam with the addition of sugar and spices. But the *puvan,* our predominent variety, will make poor jam while the *rasthali,* which is now rarer, is much better though it is inferior to the Madura hill plantain which is the fruit par excellence for jam. Again, a kind of flour or meal is said to be made by drying and grinding unripe banana slices. It is said to keep for a long time and be as nourishing as the fresh fruit. In any case the glut after harvest is avoided, while in times of scarcity, starvation may be better met by the use of

this meal. Here again our *puvan* is quite inferior to the Malabar *nendran* which is said to be the best available plantain for this purpose; though even the meal prepared from the latter was found to be unsuited to the making of superior confectionery; probably "it needs to be mixed up with a good proportion of wheat flour." [3]

Nor is the prospect for the extraction of better fibre from the plantain "stem" very bright; the fibre, as it is, is used to a limited extent in our agriculture and household; but most of the "stem" is wasted; in some villages buffaloes feed on it. Improved methods of extracting fibre have been suggested, but none has taken kindly to the simple machines in use in the Philippines—because the resultant fibre is not strong as that obtained from *musa textiles* or the *Manilla hemp* of commerce.[4] We wonder if the large quantity of organic material now going to waste cannot be utilised for the manufacture of industrial alcohol which would be a most welcome source of power in a country so much lacking in coal.

But before turning to industrial problems like these the Government in its Department of Agriculture would be doing a great good to our cultivators, if it began in right earnest to tackle the primarily agricultural problems connected with the plantain in the Cauvery Valley. Little work has been done in this district on plantains, though in the Godavari delta in recent years "the intensive system of cultivation in vogue in some of the southern districts in wet lands was introduced and some further improvements have been made as a result of considerable experience." [5] In our own district, the best varieties to be bred, the methods of manuring and of pest control, and the ways of minimising damage during transit are among the essentially agricultural problems that await solution at the hands of our scientific men. But the account given above of plantain cultivation as it is actually carried on in the Trichinopoly district, without much help from the Department of Agriculture as yet, should suffice to convince readers of the really intensive character of cultivation of this crop, which is so different from the traditional, text-book account of its cultivation.

3. Madras Department of Agriculture, No. 76: *Exhibit of Food and Industrial Products.*

4. Madras Department of Agriculture, Bulletin No. 77: *Simple Machines for Extracting Plantain Fibre.*

5. Madras Agricultural Department Bulletin No. 93: *Cultivation of Plantains on Wet lands in the Godavari delta.*

The Commercial Geography of Udyarpalayam Taluk

By

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Udayarpalayam is a big taluk of the Trichinopoly District with an area of 750 sq. miles (1931). The land rises in the middle to a height of about 400 ft. above sea-level and slopes gently towards the south and the east. There are no mountains and no important rivers in the taluk. Only ridges and sandy hillocks are seen here and there like the waves of the sea and wild streams called 'odais' which block the traffic during heavy rains are found here.

The taluk is very near the sea and hence it is not so hot as other taluks of the District. The thermometer, however, occasionally shows high readings in summer especially during May and August when the sun is at its zenith. Actually there are two seasons here of which the summer appears to be very long and the winter short. The coldest month is December and the hottest May. The winter is mild and never rigorous like that of England. The average annual rainfall ranges between 48 and 50 inches, October and November getting the heaviest rainfall from the North-East Monsoon.

The soil is fertile. The rich, sandy and porous soil which is characteristic of this area of about 50 sq. miles north and east produces dry crops like varagu, ground-nuts and kambu. On the west and the south there is a large tract of black cotton soil where cholam and cotton are cultivated in large quantities. The fertility of the soil here may be attributed to the immense deposits of iron mixture.

The actual area under cultivation during 1930-31 is 280,668 acres. About 13,277 acres are covered by forests. The native grasses, bamboos and casuarinas cover about 2,000 acres. Of the grasses, one is edible for stock and the others useful for thatching. Although a large proportion of the land was formerly considered

unsuitable for cultivation, it has now become valuable agricultural area and, thanks to the regular monsoons, usually yields a fairly good crop of ground-nuts. In addition to this area, it is not improbable that in the near future, a vast area of poramboke lands now left uncared for will, with still further means of economical cultivation, be found to be suitable for agricultural settlement. Such improvement may be rendered impossible if the demand for ground-nuts in the market continues to be as dull as it has been during the past 4 years. A branch railway from Ariyalur to Chidambaram via. Jayakondan and Andimadam is likely to stimulate the increased cultivation of ground-nuts as it will afford a ready means of transport to coastal towns.

From early days cereals like varagu, kambu, cholam and paddy had been the main products of this region, till the introduction of the African ground-nuts here. This foreign seed flourished so well that the farmers took to it immediately as it was a profitable money crop. The suitability of the soil and climate, unexcelled in any other part of the district, has enabled the farmer to be sure of his harvest. So well adapted are these conditions to the growth of ground-nuts that it is a comparatively common thing in this locality to find a variety of ground-nuts even in a small farm. It is grown as a mixed crop with varagu, kambu and red-gram. Good manuring of the soil is also done.

The ground-nut produced is of a very high quality and there is always a keen demand for it. In the French and other European markets Madras ground-nuts are eagerly sought after for soap-making and other industries. The cost of production is exceptionally low. It is possible for one man with a pair of oxen and a single plough to do all the work necessary—cultivation, manuring, sowing, weeding, reaping, etc., for from 5 to 8 acres of ground-nuts and other grains, with the exception of some assistance at weeding and harvest. This is not uncommon in this locality. During 1930-31 about 69,533 acres or ¼ of the total cultivable area was sown with ground-nuts. The quantity of production from every 4 acres may be estimated as 5 candies of ground-nut kernals which costs about Rs. 200 at Rs. 40 per candy. The out-of-the-way places transport this commodity to the neighbouring stations where there are brokers and merchants engaged in exporting them to foreign countries. Such small stations are situated at Porto Novo, Cuddalore, Vriddhachalam, Andimadam, Kumbakonam, Sendurai and Ariyalur.

The Woods and Forest Departments of the Government and the zemindar protect and rear about 13,277 acres of wooded area. The various species of Acacia, commonly called vel வேல் which comprises the major portion of the wooded area of the taluk, are widely distributed. The common names are black vel, white vel, palai, vammarai, usilai, etc. Most of these provide timber for all purposes where strength and durability are required such as beams, rafters, etc. Over a very large extent avarai, kasan and komai grow naturally and in abundance. Regular crops of bark from avarai and konnai and leaves from kasan are obtained without any outlay in respect to sowings and cultivation. There is always a demand for good quality bark of avarai, used for tanning leather, and the industry has become of such commercial importance that it has warranted the clearing of large areas of comparatively poor land for the purpose of sowing avarai. The bark of avarai can be removed 4 years from the date of planting the tree according to soil and locality. The tree has peculiarly strong roots. With a view to remove the bark at a less cost, the contractors crop out all the shoots completely and leave the stem bare. From these stems fresh shoots spring up marvellously and attain perfection in a year. Thus a single plant of avarai yields bark every year and the quality and quantity continue to be normal. Hundreds of tons of bark are exported to the tanneries at Trichinopoly and Aduturai. Udayarpalayam has practically the monopoly of this bark. Hundreds of coolies both men and women find employment here in gathering avarai bark.

Similarly konnai is another plant which also supplies bark. But a single plant yields bark only in alternate years. They take time to spring up after the first cropping.

Kasan is a shrub growing in thick bushes. The thick evergreen leaves, similar to Australian flora, the sky blue flowers, their hairy petals and the sweet and mild odour are all very fascinating. A stranger might mistake it for an orchard or a bower diligently cared for. Thus the modest kasan in its wild state grows luxuriantly and is mainly used by the villagers of the adjacent forests merely as fuel. These shrubs are burnt for charcoal and exported.

Kasan leaves are gathered and exported to Madura, Salem and other places for the manufacture of a dye. This is said to be of a very fast colour and hence the consumption becomes greater day by day.

The Cauvery Region of the Trichy District

(With special reference to Lalgudi area.)

By

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Lalgudi and its environs form part of the typical Cauvery region. The River Cauvery has its middle course right across the Trichinopoly District and adorns the valley through which it flows, with emerald fields and waving cocoa palms. From the confluence of the *Noyyil* in the west, down to the Grand Anicut (the head of the Tanjore Delta) the river wields a magic charm and turns the basin into a paradise. This is the region where the majority of the population of the district dwell. It extends for a length of 80 miles and spreads on either side of the river for about four to five miles.

The Lalgudi area has its own distinguishing marks and presents a beautiful contrast to the outlying portions of the district, which are one monotonous stretch of undulating tract, with scattered hills of igneous rock. The region is richly superlaid with the alluvium of the Cauvery deposited for several hundreds of years. The soil is favourable for rice cultivation and for the growth of plantain and betel gardens. In fact the peasants here usually resort to a rotation in rice and gardening. The irrigation facilities enable the raising of even three crops in some places. Besides these, a variety of vegetables and fruits (chief of which is the mango) is grown. The tract specially noted for this garden cultivation is the fertile island of Srirangam lying between the Cauvery and Coleroon. The island which is only 20 miles long and 2 miles wide at the broadest place is a charming region with sweet scented mango groves and enchanting flower gardens.

The fertility of the place is due to the well regulated scheme of irrigation on either bank of the Cauvery. On the south there is the South Bank Channel which has its source from the Cauvery at Kattalai. The Kattalai dam and the bed regulator have been very recently constructed at a cost of Rs. 6½ lakhs ; and the value

of the works is incalculable. The channel supplies all through the year abundant water for agricultural purposes. At Pettaivathalai, 15 miles to the west of Trichinopoly, this channel mingles with the Uyyakondan, which diffuses the water of the Cauvery into the tracts lying to the south of the Cauvery, down to the Grand Anicut, where again the channel flows back into the Cauvery after serving its useful purpose. The Mettur project contemplates a high level channel almost parallel to the Kattalai and the Uyyakondan channels and it is expected that thousands of acres of dry lands would be turned into arable lands.

Coming to the north bank of the Cauvery, we find a similar scheme in the Ayyan channel. The Ayyan channel branches off from the river at Ayyanpalayam, 17 miles to the west of Trichinopoly town. This channel through its numerous capillaries distributes the water and alluvium to the large acres of lands and finally drains the waste water into the Coleroon. The Peruvalai and the Panguni channels distribute the waters of the Cauvery to the northern limits of the basin. These channels too have their sources at the Upper Anicut.

This naturally leads us to the consideration of the Anicuts in the region and the purpose they serve. The Upper Anicut which is built at the bifurcation of the Coleroon from the Cauvery, serves to divert surplus water into the Coleroon, which becomes useful for irrigation purposes, only 60 miles lower down its course near Aduturai.

The Grand Anicut at the eastern end of the island of Srirangam is a marvellous piece of engineering skill. The plan is to regulate the supply of water to Tanjore through Vennar and Cauvery and to let out the surplus water into the Coleroon.

Life in the Cauvery valley is always enjoyable. A trip along the banks of the Cauvery would certainly delight us and would kindle in us a desire to possess a few acres in these blessed spots. We see a string of beautiful villages huddled together presenting a very picturesque and panoramic view. The sheltered hamlets, the sweet-scented groves of palms and mangoes, the swirling streams and the wooded banks of the Cauvery, are things best suited for the landscape painter or the Muse of poetry.

On either bank there are some important collecting centres. Karur, Kulittalai, and Trichinopoly on the south bank and Katu-

puthur, Musiri, Mannachanallur and Lalgudi on the northern bank are the most important of them. A railway line runs almost along the south bund of the Cauvery and the trunk road ; whereas well maintained roads permit of a busy bus-traffic on the north bank.

These centres collect the various grains and pulses from the dry interior, coming through numerous feeder roads and export daily waggon loads of grain, plantains, plantain leaves, and betels, even to such distant places as Benares and Calcutta. Trade in these commodities is very brisk everywhere. The region is inhabited by a very busy and prosperous population of agricultural farmers and gardeners. Lalgudi has a separate street known as the Kodikal Street கொடிகால் தெரு where there are about 300 families, all engaged in this lucrative occupation.

The development of the bus traffic has largely facilitated the gathering of betels and vegetables from the distant places at the town of Trichinopoly. This has naturally affected the hitherto busy transit at the ferry stations along the Cauvery, though Kattalai and Kulittalai are still busy in this respect.

There are many important shrines on both the banks of the Cauvery which are also commercially important. Starting from Karur, we have Nerur at the confluence of Amaravathi with Cauvery. Near Kattalai there is Madukarai, which once marked off the boundaries of the Chera, Chola and Pandya kingdoms. Coming down to Kulittalai we have the sacred shrine of Kadambar Koil, and 5 miles to the south, exactly on the fringe of the Cauvery basin lies the sacred shrine of Ratnagiri. It is a detached piece of rock 1,200 feet above sea-level. Apart from the sanctity of the place, a view from the top of the hill would enable us to survey the whole Cauvery region and contrast it with the barren tracts extending either way from the basin. Just opposite Kulittalai is Musiri and a few miles to the west of it is Thiruvenki Malai. Popular belief is that one attains special merit by visiting these triple shrines on the same day.

Lower down, we have Trichinopoly and Srirangam, the twin towns, which bear ample reminiscences of the ancient glory of the Cholas and the Pallavas. On the northern bank Mannachanallur is the busiest commercial centre, with numerous rice mills. This place is favourably situated to collect the products of the dry interior,—pulses and grains from Turaiyur and forest products such as bamboos, hill fruits and hill vegetables from Kolli hills,—all of

which find a ready sale in the Trichinopoly market. It will be really interesting for one to take his stand at the Cauvery bridge at Trichinopoly in the early hours of the dawn and watch the endless string of creaking grain carts and the busy crowd of the vegetable sellers with their heavy load of fresh and healthy vegetables racing to the market.

At Mannachanallur, Samayapuram, Lalgudi and Pettaivathalai are held weekly fairs. Just about the month of December during Vaikunda Ekadasi festival there is a busy cattle fair at Samayapuram.

Lalgudi has an ancient temple dedicated to Lord Siva by the Malavaraya Kings. In fact the villages surrounding Lalgudi are known as Malanadu in popular parlance or Mashavanadu as the historical accounts refer.

Besides the staple agricultural industry, there are some minor industries carried on in this region. Weaving forms the most important of these and a few places noted for the best quality of textile products are Thathayyangarpet, near Musiri, Puvalur near Lalgudi and Kulittalai. Mat weaving and wicker works are found in several wayside hamlets. In the weekly fairs raw hides are generally sold to middle-men who collect them for the tanneries at Trichinopoly. Indigenous metal works are carried on in various small places as well as at Trichinopoly.

This region of happy farmers, which we have just now surveyed, is not without its pressing agricultural and economic problems. The Landholders' Association does much to ameliorate the conditions of the mirasdars in general, that it is desirable that sufficient immunities are also guaranteed to poor petty holders.

The Development Department has initiated an agricultural farm at Lalgudi, which gives a lead in the improved methods of cultivation. In some places sugarcane cultivation is attempted with tolerable success. There are a good number of rural co-operative credit societies which do useful service to the needy farmer. But much remains yet to be done to unite these peasants to active co-operative enterprise.

Town-Planning in Ancient and Mediaeval India

By

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There is a belief widely held among us that town-planning is a modern art unknown to the ancients and that in India it has been introduced only after the advent of western ideas. It is doubtless a fact that town-planning according to western principles has been only recently introduced into this country. But towns did exist in India long before the British came here and town-planning must have been well-known at the same time. Modern town-planning has to be what it is now on account of modern conditions with the concentration of population in urban areas, industrial developments, scientific achievements and the revolution in transport facilities. Life to-day, in its broadest sense, is different from what it was in the past and town-planning in the past answered the needs of life as it was lived in the past. In the course of the present paper I shall confine myself to the examination of mediaeval town-planning on account of a feeling that we are here on more sure grounds. After the definition of a town, we can take it to mean an area affording habitation to a community that is generally large. I shall also make frequent references in the following paragraphs to the towns of Madura, Srirangam, Kumbakonam and Trichinopoly as they have the impress of the past, both remote and mediaeval, and they have absorbed modern features without losing their individuality of the past.

It may be observed even at the outset that town-planning in India to-day has a limited scope being obliged for the most part, to have its principles applied only for the modification of existing towns and cities, to think of altering which according to modern town-planning would be well-nigh impossible. A few instances might be quoted where towns have been built entirely according to modern principles—New Delhi, New Mambalam in Madras, and the Golden Rock Colony in Trichinopoly.

The origin of towns in the past in India reveals the joint operation of both accident and pre-meditation. Villages involved the least effort either in planning or forming. But the planning of a town or city meant considerable effort, forethought, pre-calculation and design, with ample scope for the exercise of the practical imagination. It also involved a good deal of analysis and synthesis. Existing forces of nature had to be recognised both in their positive or helpful aspect and in their negative or obstructive aspect. The former had to be harnessed, utilised or developed ; the latter had to be overcome or coaxed into submission.

Some of the main points which had to be borne in mind in town-planning in India in the past may be enumerated below. The size of the population to be accommodated at present and in the future received attention. Kumbakonam seems to have been planned on such a basis and the space between the Cauvery on the north and the Arasalar on the south, a distance of about 2 miles has been filled up within the last 150 years.

The supreme need which the place must answer must have been predominant in the minds of the designers. The site, the form and other features reveal a military, religious or commercial purpose as the predominant view of the enterprise.

It was the monarchy and the aristocracy that took the leading part in the designing and developing of towns. Others merely carried out the intentions of the leaders. There seems to have been no distinction made between public and private lands.* Those in power had all the land at their disposal. The present-day distinction between private and public lands is based on the right of the private individual to challenge in a court of law the encroachment of the State on his private domain. If the individual had such a right in the past, then it must be granted that there was a distinction between private and public land in ancient and mediaeval India.

Among the motives determining the planning of towns may be mentioned in order—necessity, utility and beauty. But the Indian conception of life and art drove them to combine all these.

* An eminent authority on Indian History holds that such a view is one of the standing myths of Indian History for which some western writers and their Indian followers are responsible.

Things of necessity and utility were endowed with the charm of beauty which the artist imparted to them. Contrast the drinking vessels of Indian homes in the past with the present-day standardised cups.

Town-planners in the past were unhampered by the embarrassments of modern town life—pressure of population, municipal finance, costly schemes and experiments, sanitary lanes, slums, housing schemes, disposal of sewage and night-soil, water-supply, etc. Towns have been so built as to maintain communication with the neighbourhood and other important parts of the region. The need for contact with other places was steadily kept in view. Sanitary principles were understood and practised on the basis of an unwritten convention and code of law. Differing levels of ground within the area where the town was to grow received recognition and were duly conformed to. Ample space was provided for the needs and even the growth of the population. If the place happened to be designed for a capital, connection with other parts of the territory was an important factor to be borne in mind.

In the planning of capitals much thought had to be bestowed on details. Provision for royal residence had to be made both as regards site and extent as becoming the ruler's dignity as head of justice, order, society and the army. He was not however, head of the religion. Ample additional space was sliced off for the royalty. Provision was made for royal amusements. The open space before Tirumal Naick's palace in Madura and the one in the Dariya Doulat at Seringapatam for the entertainment of Tippu and his harem are existing even to-day. The most important factor in the planning of capitals was the fort. Many a town in the past in India had a fort—a kottai—as opposed to which there was the pettai, the resort of the mercantile community. The kottai was the residence of the royalty, the nobility and probably the elect among the priests. There are numerous towns even to-day with a kottai and a pettai, many without even a trace of the former except the name which sticks on. The army was stationed not far from the capital, the place being known as Palayam, sometimes with some prefix as Kumarapalayam, Pallapalayam and Mettupalayam. Palayankottai is significant as indicating a garrisoned fort.

The choice of the site was a very important preliminary action in town-planning and was done under sacred auspices with due regard to the aspects of the planets, the longevity of the town being

looked upon as being dependent on the nature of the planetary conjunctions. The natural advantages offered by the site received special attention. Easy or near communication with other parts was a military or political necessity. Nearness to or distance from hostile territories was a no less important consideration. A commanding position was a very great recommendation. Some striking natural feature as the rock of Trichinopoly or the two rivers in Kumbakonam and Srirangam attracted town-building. Access to sources of food-supply was, along with other factors, duly borne in mind. The Duke of Wellington in his famous despatches of 1800 from Seringapatam has paid a glowing tribute to the genius of Hyder in the matter of the choice of Seringapatam for his capital. Sea-ports found great favour among our ancients in the south for erecting their capitals as in the case of Thondi, Vorkai and Kaveripatnam. But the vagaries of the sea seem to have taught them to look more inland for sites for their capitals. This does not mean that they gave up their maritime activities. Not being forced like the Dutch or the English to carry on a perpetual struggle with the sea for existence, they chose capitals at a distance safe enough from the sea without giving up the advantages of sea-faring. With the development of an intense religious life on the part of the South Indian Rulers they might have also tried to avoid contact with foreigners in the sea-ports and the consequent irreligious tendencies, anything foreign being considered irreligious.

Taking for examination the towns of Kumbakonam, Trichy, Srirangam and Madura, we find several things of interest. Many of them have had notable contributions from the aristocracy as for example, Madura, Kumbakonam and Srirangam. Saints have played an important part in such enterprises. Tirumangai Alwar robbed many a Peter to pay Sri Ranganatha whose temple-walls are a literally standing testimony to the saint's contributions.

Some of the chief features of a town as revealed by a study of the above-mentioned four may be mentioned below. The disposition of the other parts of the town and the main buildings was determined by the location of the temple which was accorded a central site. The palace was next in importance and at a respectful distance from the temple whose vicinity was left undefiled by the neighbourhood of human habitations which were usually at a distance from both temple and palace. The entire area was surrounded by fortifications. The mercantile community was given a place suited to the carrying on of its transactions. The artisans

were under the special protection of the rulers and the aristocracy. Art flourished particularly under the rulers of Tanjore and Mysore. The working classes were distributed over the remaining space and mostly on the out-skirts of the city. Regiments were given special quarters. There were stables for elephants and horses and spacious and well-protected sheds for cows. It was not unusual to have a royal menagerie. The services including religious were specially provided for. The priestly order every one of whom was learned were the deserved recipients of gifts of agraharam many of which were by the riverside as in the four towns mentioned above. The temple had a car attached to it and streets four-square were laid for the car to run its annual round generally at the end of a festival. The fair, a concomitant of the festival, was accommodated in a well-known place. The "diddi" was a bye-way, an opening in the surrounding walls to allow the car-rope to be so drawn as to facilitate the turning of the car at particular angles, a feature peculiar to Srirangam. There was the tank for the floating festival, an unconscious provision at the same time for open space, free air, and a public bath. The location of the tank was such as to maintain connection with sources of water-supply. This can be seen in the Mahamakham tank in Kumbakonam, the Perumal and Mariamman tanks in Madura and the temple tank at Srirangam. Unfortunately, to-day many of the tanks have become formidable problems for our municipalities and serious proposals have frequently been made for the closure of many of them as they have become so far polluted under modern conditions when our people have forgotten or given up the observation of sanitary principles, that they constitute a real menace to public health.

The different classes of society were distributed according to the importance of their services and disposed in groups. The temple priests lived close to the temples. The devadasis seem to have been competitors with the priests in this respect as may be seen in Madura. The mandapams of temples with raised platforms functioned as lecture halls. Separate places were allotted in temples for the practising of the fine arts, as one can find in Madura. There were public gymnasia under the supervision of professional athletes known as "jetties." The royalty had its own theatre in a part of the palace. The populace were entertained in the streets or open spaces where the Harischandra Natakam was performed in a theatre erected extempore. Provision was made for the cremation ground by the river side wherever possible. Hindu and

Muhammadan kings provided for places of worship for their respective co-religionists, as can be seen in Madura, Tanjore and Mysore. Hyder and Tippu with all their alleged fanaticism have left the temple of Sri Ranganatha in Seringapatam intact while not a stone is left to tell where their palace stood. The Maharatta kings of Tanjore have endowed Muhammadan Mosques.

Town-planning may be said to have passed through three stages town-planning, town expansion and town-extension, the last of which may be seen in many places to-day. Expansion consists in filling up the spaces left vacant in the original town-planning. Extension is now going on outside the old limits and many of the principles of modern town-planning find application here subject to financial and other considerations.

The main street was generally east to west; southward-looking houses were preferred to others. In changing houses, it was considered lucky to move from west to east, while the opposite was considered contrary. Towns and streets were named after rulers or important personages or the local presiding deities.

It will be seen from all the above that in India in the past, town-planning was a well-known art, answered the needs of the population existing and disclosed the salient features of a communal life which had attained a high degree of civilisation.

The Urban Geography of Trichinopoly and Srirangam

BY

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Trichy with its suburbs plus Srirangam and Golden Rock competes with Madura as the largest agglomeration of population in the presidency outside of Madras city.

I have in writing about other cities commented on the lack of physical raison de'tre for their location. This cannot be said with respect to Trichy situated as it is on the banks of the Cauvery near its bifurcation with the Coleroon and not far from Grand Anicut and where the rivers are crossed by the Great Southern Trunk Road. Later its development as a very important railway junction and the head quarters of a great railway system has been sufficient to account for the growth in population. The railway work is the only large industrial development but there are three other factors which have a considerable influence on population—it is a District Head-quarters, important Educational centre and a cantonment. Moreover the Rock Temples at Trichy and the two Great Temples at Srirangam give the group a religious importance second to none in the Presidency.

The precipitous rock rising to a height of about 250 feet with its Temple in the centre of the city is the dominant physical feature. Otherwise the terrain slopes gently up from the river towards the South whilst Srirangam on its island between the two rivers is dead level a few feet above river level and liable to submergence during the South West Monsoon.

The growth of the two towns has been fairly regular and sustained during the last 60 years—Trichy having increased from about 73,000 to 1,43, 000 and Srirangam from 11,000 to 24,000. Both towns suffered a set back in the decade ending 1921 but in the case of Trichy, the falling off has been much more than made up since, in spite of the fact that the new " Garden suburb " of Golden Rock has come into existence during the last decade and now

has a population of 14,000 some of it drawn from Negapatam owing to the closing of the railway works there.

Trichy exhibits the normal great contrast in density between the spacious cantonment, where there is a considerable amount of open space, and the congested Fort Area where there is none. The Fort is a rectangle 1½ miles from North to South and ½ mile from East to West. It was laid out originally on rectangular lines but now consists of a congeries of narrow lanes and culs-de-sac amongst which there are more than a score of tanks originally connected by conduits for the supply and circulation of water from the river but now, owing to the disuse of the conduits, they are stagnant, insanitary and nauseating.

The original fortifications have nearly disappeared but portions can be seen on the north side along the Butterworth Road and a section of wall and gateway on the west and in their place along the East, South and West sides are the Boulevards or it would be more correct to say were, for these valuable open spaces, which might mean so much for the health and happiness of the community if properly laid out and controlled, are gradually being submerged under an unpleasant collection of Kutcha huts, godowns, latrines and other junk owing to the deplorable failure to preserve them from encroachments. An evening ride or walk round the Boulevards which should be a pleasure would be to-day an offence both to the nose and eyes.

Beyond the Boulevards on the South the town has grown up in a haphazard and untidy manner with little or nothing to commend it to the student of Municipal development; on the East there are similar areas on a small scale, to the west beyond half a mile of highly cultivated irrigated fields are the large suburbs of Puttur, Tennur and Woriyur. There has been a good deal of development in recent years along the Tennur Road and this development is likely to continue owing to its convenient location between the old Town and the Courts and Government Offices. These latter are located in the cantonment area. The Collectors' Cutchery is on the western limits of the cantonment about 2½ miles from the centre of the Fort.

There is not much of note in the architecture of Trichy. The District Court designed by Mr. Thomas is an imposing edifice; the St. Joseph's College is a fairly impressive group dominated by the

florid Church with its massive spire. The New Railway Station and the adjacent railway buildings, will be a great addition to the architecture of the City when complete.

The most picturesque view in the town is that of the Fort seen from the West with the Teppakulam Tank and its surrounding buildings in the foreground.

Trichy extends altogether about 4½ miles from North to South and about 2½ miles from East to West. It has a hot dry climate, the annual mean temperature being 84° and the rainfall about 26 inches. Except in the irrigated areas the growth of trees and garden produce is handicapped by the climatic conditions and in parts by the laterite or rocky nature of the soil.

Srirangam on the other hand, lying as it does on low land between the two rivers exhibits the luxurious characteristics of a west coast town, largely no doubt due to the multitude of cocoanut palms. It has urban characteristics which are unique amongst the towns of the Presidency, the town or the older part of it lying within the outer temple walls. These massive stone walls served as protection from river floods to which the island is subjected during heavy South-West Monsoons but in other respects they can hardly improve the living conditions within. The Srirangam temple is square in plan with seven complete walls and 15 Gopurams. It is noted for its valuable collection of Jewels. The Jambukeśvaram temple is oblong with five walls also with streets and houses between the outer two walls. Architecturally it is considered to be superior to the Srirangam Temple.

Srirangam has a total length from East to West of 4½ miles and from North to South of 1½, being only ½ a mile wide at the west end. Whilst the extent of the town is 5 square miles, by far the greater part is garden and cultivated land, the population being concentrated within the vicinity of the Temples. The Trunk Road and the new Trichy—Villupuram chord Railway cut across the town being carried across the two rivers by girder bridges.

To the South-east of Trichy in absolute contrast to both Trichy and Srirangam lies Golden Rock the new S. I. R. Township. This is a complete town entirely planned and controlled on town-planning and sanitary lines, the nearest thing to a garden city that South India can show, and has a population about equal to that

of Letchworth, the first garden city. It has its own special form of Government under the surveillance of the S. I. R. authorities. Golden Rock is a very useful object lesson of what a town can be in India and it will in future, I have not the slightest doubt, provide some very useful and illuminating comparative data with respect to the physical, mental and spiritual benefits of town-planning and efficient administration and control. To some extent no doubt the dice are loaded in favour of Golden Rock as the level of employment and income will be above the average ; but on the other hand the large majority of the population will be of the labouring class living in lines of one room houses.

Thus in Trichy and its Neighbours the Geographical Association will have a valuable opportunity of seeing the good and bad and also the unique in Urban Geography in South India.

Urban Geography of Karur

BY

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1. Karur is an important Municipal town in the Trichinopoly District, next only to Trichinopoly and Srirangam in population, commerce, industry and general interest. It is on the Trichy-Erode Branch Line of the S. I. R., 48 miles from Trichinopoly. It is bound on the South and East by the river Amaravathi, a tributary of the river Cauvery. The railway line forms its northern boundary. To the west are cultivated wet lands. Longitude 78°5′ E, and Latitude 11°58″ N. fix its position on the globe. It covers an area of about 1.68 sq. miles. Its surface is flat, and it is about 400 feet above sea level.

2. The name Karur is supposed to mean 'embryo village'. Tradition ascribes this name to the fact that Brahma began his work of creation at this place; hence this town is also known as 'Brahmapura'. In the Sthalapuranas this town is referred to as 'Garbhapuri'.

3. 'Karur was apparently a place of some importance as far back as the early centuries of the Christian era, for silver coins of the Roman Emperor were found near it in 1806. Situated as it was near the point where the territories of the rival Chera, Chola and Pandya dynasties met, it must have played its part in their ancient struggles'.

4. Like many cities of India, ancient and modern, Karur has a well established raison d'etre for its growth and importance. Situated on the bank of the river Amaravathi, about 6 miles from its confluence with the river Cauvery, at the meeting place of four important roads leading to four different districts—Coimbatore on the West, Trichinopoly on the East, Madura on the South and Salem on the North and standing on the Trichy-Erode Branch of the S. I. R. connecting the eastern portions of Peninsular India with the western portions, Karur occupies a position which has attract-

ed a considerable amount of trade and has made it an important trade centre of the district.

5. The river Amaravathi rising in the Anamalai Hills, after travelling a long distance in the Coimbatore District and the Karur Taluk enters the town in the south-west corner, flows almost east, makes a bend and then runs almost north. Its length within the Municipal limits is about 1 mile 7 furlongs. Though the Municipal limits extend to the other side of the river, the course of the river has given the town proper a rectangular shape, making it possible to extend the town only on the western side along the Coimbatore road. The river is broadest in the North-east and South-west corners of the town, being about 1420 feet, while its breadth at its narrowest part is about 620 feet. It is spanned by two bridges, a railway bridge and a road bridge. The latter was built in 1920 and it has facilitated traffic to Aravakkurichi, Dindigal and Trichinopoly. During the summer months the river is almost dry, people dig springs in the sand and take water for drinking purposes. The river is in floods regularly in June, July and August and again in December. During the other months there is sufficient flowing water, its volume varying with the supply at the source.

6. The town is rectangular in shape, compact, well-planned and developed. The main streets are tolerably broad and parallel, crossed at short distances by lanes and streets. The extension, Narasimhapuram, has been laid out according to modern town-planning principles. The town is rapidly extending west, the wet lands being converted into house sites. The names of some of the streets afford an interesting study, as they give us a glimpse into the life and occupations of the people that formerly lived in them, though they are now occupied by people of different callings.

"Keeraikkara Street" :— (கீரைக்காரத் தெரு). The people here were evidently engaged in the cultivation and selling of leafy vegetables.

"Valayalkara Street" :—(வளையல்கார தெரு). The manufacture and trade in the native lac-stick bangles, perhaps, formed the chief occupations of the people living here. Even to-day many of its residents carry on bangle manufacture and trade, though on a small scale.

"Okkiliyar Street" :—(ஒக்கிலியர் தெரு). Probably this was the residential quarters of cattle herds, dairy farmers, and milk and

curd vendors. But now the town's main supply of milk, curd and ghee comes from the surrounding villages. "Kodikkara Street": (கொடிக்கார தெரு). The people living here were formerly engaged in the "Kodikkals," betel plantations. "Gandapodikkara Street": (கந்தப்பொடிக்கார தெரு). Mahomedans live in this street, engaged in making and selling scented sticks known as "Oodubathies" and scented powder. There are many more of this kind.

7. The climate of Karur is hot and dry. The temperature ranges from 82.5° F. in the month of December to 92° F. in April, December being the coldest and April the hottest of months in the year. (Vide the mean monthly temperature graph). The summer heat becomes unbearable in the months of March and April, when both days and nights are very hot and enervating. The S. W. Monsoon winds set in by the end of May; and Karur facing the Palghat Gap, for the next two or three months, receives steady strong gusts of wind daily. The town gets rain both from the S. W. Monsoon and the N. E. Monsoon, but the rain received from the S. W. Monsoon is not abundant. The total amount of rainfall in 1932 was 28.85″ of which 9.55″ fell in June and August, .45″ in April and the rest (18.85″) in the months of September, October, November and December. (Vide monthly rainfall graph). There are two rainfall maxima, one corresponding with the S. W. Monsoon and the other with the N. E. Monsoon. The N. E. Monsoon gives greater quantity of rain, but the S. W. by its cool winds and lighter showers considerably lessens the unbearable summer heat.

8. The recorded population of Karur has been as follows:—

1871 —	9,378	1911 —	17,674
1881 —	9,205	1921 —	18,249
1891 —	10,750	1931 —	19,850
1901 —	12,769		

Between 1871 and 1901 there was an increase of 36.2% and between 1901—1931 an increase of 55.5%. Between 1901—1911 the population of the town rose from 12,769 to 17,674. This sudden increase in the population was due to the inclusion within the Municipal area of the village lying on the outskirts of the town. From 1911 to 1931 there has been a steady increase due to various causes. The establishment of factories, the consequent growth of industries and commerce, the immigration of rural population for labour and employment and the transfer of the town

from the Coimbatore to the Trichinopoly District are some of the reasons for this steady rise in population.

9. The Hindus form 89% of the population, all the different sub-castes of the Hindus being well represented. Special mention must be made of the Arya Vysia community, about 1,500 strong, living in the heart of the town. Being a hereditary trading caste all of them are engaged in trade in different articles, and so they constitute a wealthy class.

10. The Mahomedans who form about 7% of the population, are concentrated in the south-east portion of the town. Their chief occupations are trade in skin and hides, manufacture and sale of scented sticks and retail trade in sundry articles.

11. The Christians constituting 3.4% of the population, have formed a separate colony in the north-west part of the town. Most of them are employed in the Wesleyan Mission Industrial School and Workshop.

12. The Depressed classes whose strength is about 13% of the population, live in their cheries on the outskirts of the town. Most of them are agricultural labourers, while some are employed by the Municipality in sanitary work.

13. Karur is an important industrial centre of the district, the most important industry being that connected with cotton—cotton ginning, weaving and knitting.

14. There are three recently established cotton ginning factories with 20 ginning machines worked with oil engines of horse power ranging from 10 to 35. Nearly 400 hands are daily working in these factories, the total daily output being about 2,500 lbs. Raw cotton for these factories comes from the dry areas of the Karur Taluk lying to the west of Karur town. It is estimated that Karur Taluk alone can supply raw cotton for a dozen ginning factories. All ginned cotton is sent to Tiruppur.

15. From very early days Karur has been famous as a weaving centre. There are 6 weaving factories with a total of 150 handlooms. Besides these factories, there are about 50 looms owned and worked by private individuals. The chief articles made are bedsheets, towels, carpets and dhoties. The Karur towel and bed-

sheet are very popular in the Tamil districts and find a ready market. About 1,800 yards length of bedsheets and 1,000 towels of varying dimensions are daily woven in Karur. About 2½ miles from Karur in a village known as Koyamballi live "Seniyans" (a weaving caste) who are engaged in weaving "a peculiar kind of women's cloths made with a warp of cotton and woof of silk." About 200 hand-looms are at work in this small village.

16. Banian knitting is also an important industry in this town. 25 knitting machines are working, producing daily about 10 dozens per machine. The Karur Banian is also famous in the Tamil districts. All the cotton yarn required for weaving and knitting is purchased from other places. In some of the weaving factories, dyeing is also carried on with the dye stuffs mostly imported from Madura.

17. One important thing to be noted in connection with the cotton industry of this town is this. All the cotton ginned here is exported to other places; all the yarn required for weaving and knitting, is imported. This is due to the absence of a spinning mill in this place. The climate of Karur, which is hot and dry, is not well suited to cotton spinning industry. Moreover the total output of all the ginning factories is not sufficient for the successful and profitable working of a spinning mill. To these must be added the absence of necessary capital and business enterprise. It is hoped, however, that in years to come the increase in the number of ginning factories, the greater demand for yarn as a result of the increase in the number of weaving and knitting factories, the introduction of electricity for supplying cheap power to run these factories, all these would facilitate the establishment of a spinning factory which would fill up the gap, and link the two industries of ginning and weaving, now carried on in Karur.

18. There are many other industries and handicrafts which need a mention. 8 Rice Hullers and 6 Groundnut Decorticators are working daily, giving work to nearly 150 women coolies. There are 50 country oil mills worked with bullocks. Chunam grinding, flour milling, beedi-making, sugar-candy manufacture, lac-stick bangle and country glass bangles making, mat and basket making, and rope twisting, etc., are some minor industries of this place. Rattan work and wooden furniture of all kinds are also made chiefly in the Wesleyan Mission Industrial School and Workshop.

19. Next to Trichinopoly Karur is an important trade centre of the district, carrying on relatively a very large volume of trade. What Karur buys and sells is indicated below :—

What Karur sells.	Places.	What Karur buys.	Places.
1. Loose Cotton.	1. Koilpatti 2. Tiruppur	1. Paddy	1. Tanjore 2. Nellore
2. Cotton Seeds.	1. Erode.	2. Salt.	1. Tuticorin
3. Castor Oil.	1. Madura.	3. Grains of all kinds, spices etc.	1. Tuticorin 2. Calicut
4. Plantains.	1. Pollachi 2. Sulur 3. Tiruppathur 4. Krishnagiri 5. Bangalore 6. Madras.	4. Tamarind.	1. Bangalore 2. North Arcot
5. Coconuts.	1. Kopbal 2. Anantapur	5. Flour of all kinds.	1. Tuticorin 2. Bangalore
6. Jaggery.	1. Adoni 2. Tanjore 3. Kumba-konam	6. Kerosene Oil.	1. Ernakulam
7. Ghee.	1. Tanjore 2. Trichy 3. Mayavaram 4. Bangalore 5. Mysore	7. Cotton Yarn	1. Madura 2. Erode 3. Coimbatore 4. Singanallur
8. Turmeric.	1. Kumbakonam 2. Tanjore 3. Bangalore 4. Mysore 5. Calcutta (Occasionally.)	8. Gingelly Oil.	1. Erode

What Karur sells.	Places.	What Karur buys.	Places.
9. Dried Chillies.	1. Tanjore 2. Kumbakonam 3. Erode 4. Pondicherry 5. Andhra Districts (Occasionally.)	9. Coconut Oil	1. Quilon 2. Trichur.
10. Groundnut, Dhal	1. Negapatam (for shipment) 2. Tanjore (only a small quantity)	10. Sugar.	1. Nellikuppam 2. Calicut 3. Cochin 4. Tuticorin
11. Banians, Towels etc.	1. Trichy 2. Salem 3. Trivandrum 4. Cochin 5. Ernakulam 6. Tellichery 7. Bangalore 8. Tuticorin 9. Quilon 10. Chidambaram 11. Bezwada 12. Mangalore 13. Secunderabad	11. Timber	1. Negapatam. 2. Malabar
12. Gingelly Oil.	1. Salem 2. Trichy 3. Madura.	12. Cotton Goods. (piece goods)	1. Madras 2. Tiruppur 3. Erode 4. Coimbatore
13. Dhal.	1. Tanjore 2. Trichy 3. Salem	13. Cigars.	1. Trichinopoly
14. Rattan Works Wooden articles.	1. Erode 2. Quilon 3. Tellichery	14. Brass and copper vessels.	1. Kumbakonam

The above table shows that cotton, turmeric, dry chillies, plantains, cotton goods (Banians, towels), etc., form the chief exports, and paddy, salt, cotton yarn and sugar, etc., the chief imports. Most of the export of Karur consists of dry crops. This is due to the fact that a large portion of the Karur Taluk is occupied by dry lands growing only dry crops. Taking imports we find that they

consist of a large variety of commodities. A large quantity of paddy is imported because the paddy grown here is not sufficient and the paddy of Karur costs more than the Tanjore paddy. Karur does not import articles of furniture, but on the other hand, it exports them. This is due to the Industrial School and Workshop, found here.

20. Besides the daily market, a weekly shandy (fair) meets here on Saturdays, when cattle, food grains, cloths, etc., are brought for sale. People from all the surrounding villages regularly visit this shandy and make their purchases.

21. Karur is also a place of great religious interest. The principal temple is that dedicated to Lord Siva, named Pasupatheeswara, with a gopuram 150 ft. high. The temple is said to have been built by a Chola king. It has been renovated by Nattukottai Chettiars. The temple contains the tomb of a local saint known as Karuvurar. The festival of this temple takes place in the month of Panguni, (March-April) and on the Panguni Uttaram day a big car is drawn round the four principal streets of this town. Large crowds from the adjoining villages would assemble here on that occasion.

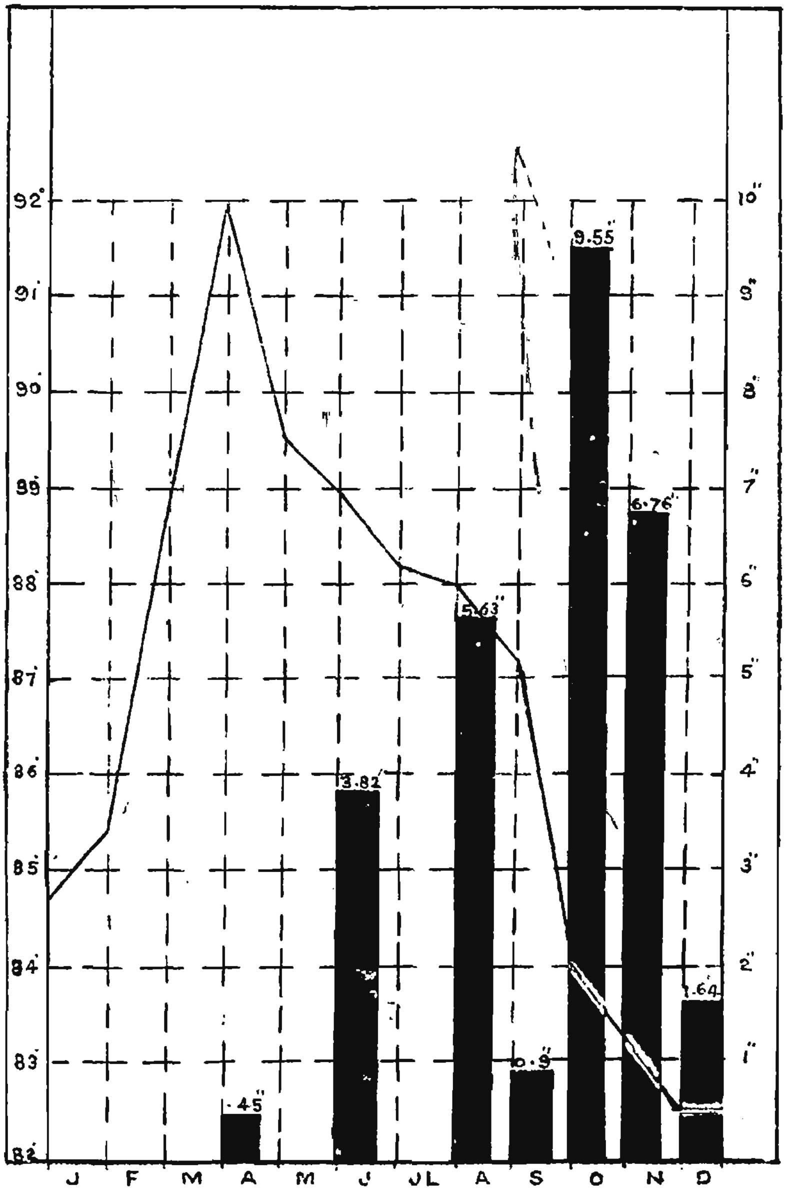
22. The Mariamman temple situated in the heart of the town is dedicated to a local deity. Its festival, celebrated in the month of May, is gaining increasing popularity and attracting huge crowds from all the villages of the taluk.

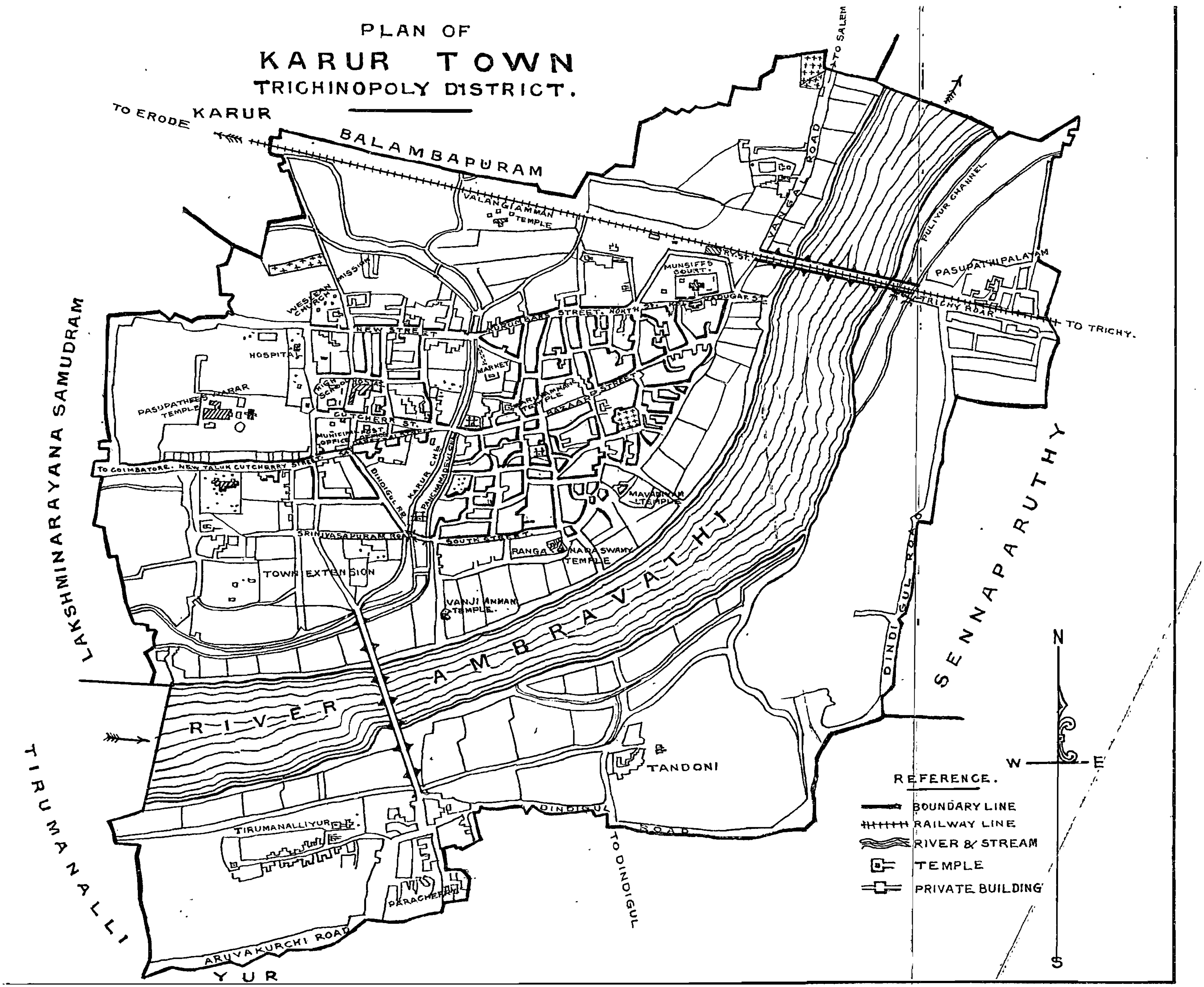
23. There are two churches, one belonging to the Wesleyan Mission and the other belonging to the Roman Catholics. There is also one big mosque for Moslems.

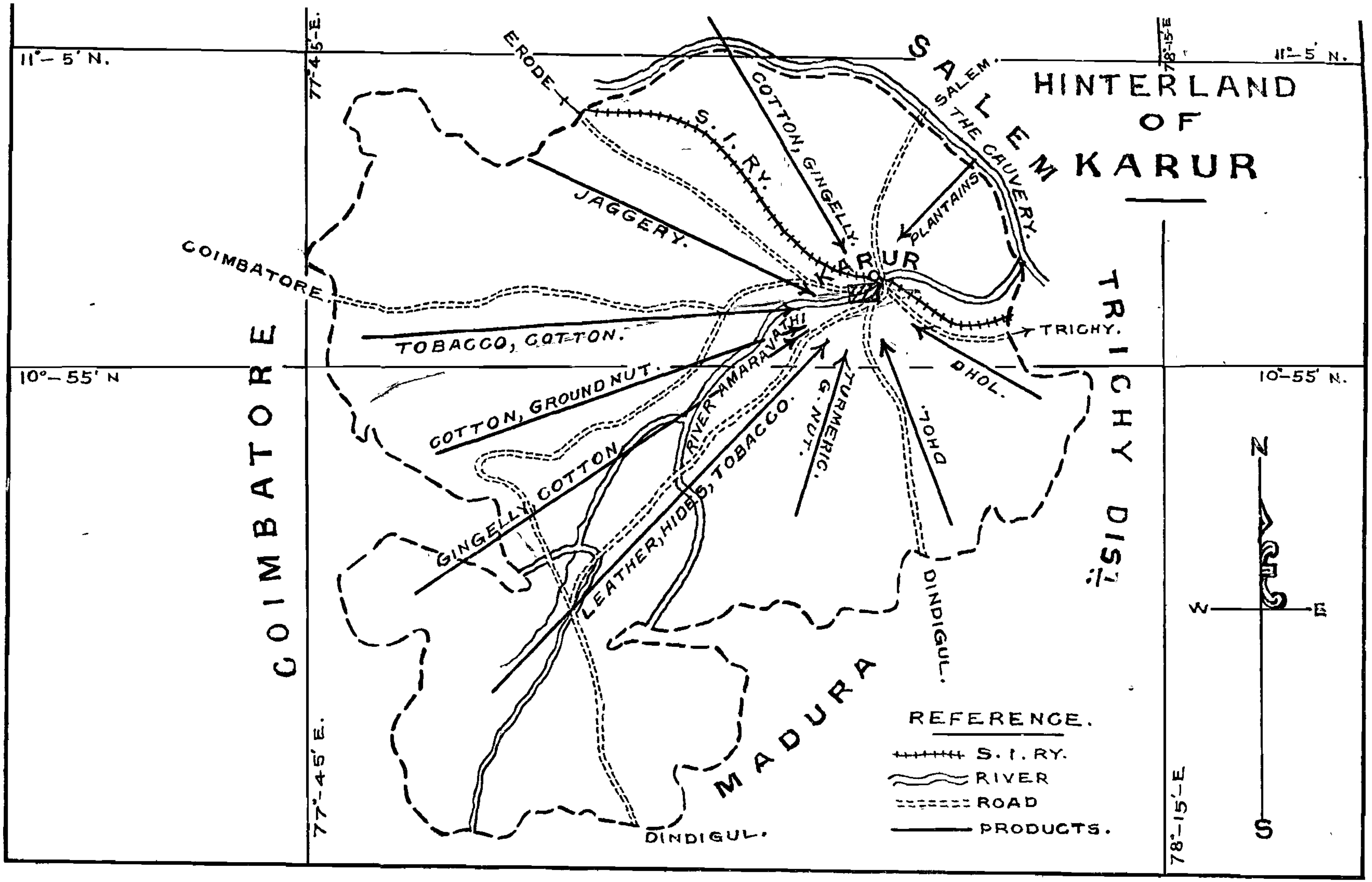
24. The Wesleyan Mission Industrial School is also a place of interest in this town. This institution is maintained by the Mission. From small beginnings it has developed into a big industrial school. It has weaving, rattan, smithy and carpentry departments, where many useful and artistic articles are made and exported.

25. About 2 miles to the south of Karur is Tandoni, a great Vaishnava pilgrim centre. On a small hill in the centre, is the temple of Venkataramanaswami. The image of the deity is cut out of a portion of the solid rock. The shrine is considered very holy and vows are taken here often. As at Tirupathi, Upanayanams and marriages are celebrated here by pilgrims from different

MONTHLY RAINFALL & MEAN MONTHLY TEMPERATURE OF KARUR TOWN




PLAN OF
KARUR TOWN
TRICHINOPOLY DISTRICT.
TO ERODE
KARUR
BALAMBAPURAM
TO SALEM
VANGAL ROAD
VALANGIAMMAN TEMPLE
PULIYUR CHANNEL
MUNSIFFS COURT
PASUPATHIPALAYAM
TRICHY ROAD
TO TRICHY.
WESLEYAN MISSION CHURCH
NEW STREET
KURUMBARS STREET
NORTH ST.
MARKET
HOSPITAL
HIGH SCHOOL
PASUPATHEES BARAR TEMPLE
CUTCHERRY ST.
BAZAAR STREET
MUNICIPAL OFFICE
POST OFFICE
TO COIMBATORE. NEW TALUK CUTCHERRY STREET
DINDIGUL RD.
KARUR CH.S.
MAVADIYAM TEMPLE
SRINIVASAPURAM ROAD
SOUTH STREET
RANGANADASWAMY TEMPLE
TOWN EXTENSION
VANJI AMMAN TEMPLE
LAKSHMINARAYANA SAMUDRAM
SENNAPARUTHY
RIVER AMBRAVATHI
DINDIGUL ROAD
TANDONI
TIRUMANALLIYUR
PARACHERI
TO DINDIGUL
ARUVAKURCHI ROAD
TIRUMANALLI
YUR
N
W
E
S
REFERENCE.
BOUNDARY LINE
RAILWAY LINE
RIVER & STREAM
TEMPLE
PRIVATE BUILDING


HINTERLAND
OF
KARUR
SALEM
TRICHY DIST.
COIMBATORE
MADURA
KARUR
SALEM.
THE CAUVERY.
ERODE
S. I. RY.
COTTON, GINGELLY.
JAGGERY.
PLANTAINS.
COIMBATORE
TOBACCO, COTTON.
COTTON, GROUND NUT.
GINGELLY, COTTON
RIVER AMARAVATHI
LEATHER, HIDES, TOBACCO.
G. NUT.
TURMERIC.
DHOL.
DHOL.
TRICHY.
DINDIGUL.
DINDIGUL.
11°–5′ N.
10°–55′ N
10°–55′ N.
77°–45′ E.
78°–15′–E
N
S
W
E
REFERENCE.
S. I. RY.
RIVER
ROAD
PRODUCTS.

parts of the district. The chief festival of this temple is celebrated in the month of Purattasi (September) when specially on Saturdays, very large crowds gather here for worship—the worshippers include all castes and sects of the Hindus. 2 miles west of this is an isolated tomb raised to the memory of the officers and sepoys who were killed and wounded in the siege of Karur in 1783.

26. 2 miles to the north of Karur, on a small hillock known as Vennaimalai is the temple of Balasubrahmanya. This is also a local pilgrim centre. This has been recently renovated by Nattukottai Chettiars. Its chief festival comes on the Thai Pusam day and is celebrated on a grand scale.

Some Place Names in Trichinopoly District

By

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The object of this paper is to inform and amuse the mind and, if possible, to stimulate it to making new discoveries in the region of the past. Such an object can be achieved only if one can dive deep into the past and gather information either of an antiquarian and legendary nature or historical and useful kind. The former will help us to enjoy and the latter to construct and weave an unbroken history. The learned Chairman is one who has done much diving work and is an expert in transforming things antiquarian and archaeological into facts of great historical importance and value. I am neither a historian nor a student of history and it is most inexcusable that I should make an attempt where angels would fear to tread.

> " What's in a name ? that which we call a rose
> By any other name would smell as sweet."
>
> *Romeo and Juliet.*

So sang Shakespeare three hundred years ago and surely Trichinopoly would be just as hot as to-day even if it were called " Iceberg " or " Snowball." The ancient city of Madura would smell just as nasty, were you to call it " Rosewater " or " Attar Stick." However, it must be admitted, names play an important part in the history of individuals as well as of nations. In naming children people take care to call them by those of famous men. In India children are named after Gods and distinguished heroes in the belief that a constant pronunciation of such names, whether consciously or unconsciously, would bring salvation to their souls. Who is not familiar with such names as Ramaswami, Krishnaswami, Subramanian, Lakshmi, Saraswathi, Savithri, Meenakshi and so on. The transformation of St. Petersburg into Petrograd, then into Leningrad shows that even nations attach importance to names.

My duty to-day is to take you round this district of Trichinopoly for half an hour, not in electric train nor by aeroplane but, in the car of imagination and draw your attention in my humble and unscientific manner to the legends that lie buried or to the history that stands out in bold relief. Some names of places have undergone such a metamorphosis that it requires an imaginative skill to discover their original dress. There were two Reddy brothers living in Karur about 300 years ago. The younger Chinnappa Reddy quarrelled with the elder and like the prodigal son of the parable took his share and went off with his friends to a place two miles away east of Karur and founded a village. It was first known as Chinnappareddiyur (சின்னப்ப ரெட்டியூர்) the suffix was dropped and the Indian tongue has made it Chanappiratti (சனப்பிரட்டி). While once travelling with a friend I was asked by him if any one was living in that village who will turn the people upside down and make them rebel against the British Raj !

The English Regiment in the days of the East India Company used to get to a place four miles to the south-east of Trichinopoly, divide themselves into two companies and practise sham fights for exercise ; for, those days were days of constant wars and frequent fightings and the English had to be always on the alert. A small village was formed in the neighbourhood consisting of camp followers and bazar men who sold cigars and plantain fruits to the soldiers and the village of " Sham Fight " has come to be known as the village of Sampattu (செம்பட்டு). An unwary student of Indian History might in later days even go so far as to say that in the palmy and prosperous days of Chola Kings, *red silk* was manufactured in that once renowned town of Sempattu (செம்பட்டு).

Trichinopoly is an inland District wedged in between Tanjore and Pudukottah on one side and Salem and Coimbatore on the other. The river Cauvery and its valley bisect the District, the northern half consisting of two ranges of hills, the Pachaimalais and Kollaimalais and the southern half being broken up by scattered rocky heights which are covered for the most part with scrub jungle. Here and there one finds isolated masses of crystalline rocks of which the great Trichinopoly rock, the Golden rock and the Ratnagiri hill near Kulitalai are prominent examples. The District is made up of seven Taluks namely, Trichinopoly, Lalgudi, Udayarpalayam, Perambalur, Musiri, Kulitalai, and Karur. Let

me first explain the origin of these Taluk names before I take up the names of other towns and villages in the District.

Trichinopoly. This is only a modification of *Tiru Sira Palli* (Town of Tiru Siras) or three-headed brother of Ravana who is said to have founded this town. *Palli* corresponds to *patti* or *Padi* and means a town.

Other variations are attached to this place *viz.* Tiru Sila Palli=holy rock town and Tiruchinapalli—holy little town. *Sirapalli* is the name that occurs in all Puranams and in the Devarams. Woriur was the capital of the Chola King who came from Pukkar riding on an elephant in search of a place for his capital and who was met by a cock which drove back the elephant. The king was so much enamoured by the courage of the cock that he decided to make Woriur his future capital. It is said that on account of want of devotion on the part of a Chola king for God Thayumanavar, the city was destroyed by a rain of sand. This is only a poetical way of saying that the Cauvery breached in 1100 as it did in 1924 and brought in heaps of river sand and covered up the city as the floods of 1924 did cover about 200 acres of smiling paddy fields near Mutharasanallur and Murungapettai!

Lalgudi lies 13 miles north-east of Trichinopoly. The name is said to mean Red Place and to have been given to the town by the Mohummadans owing to the red colour of the gopuram of the Siva temple. But Lalapet does not mean '*red town*' for "Lala" refers to the Lala merchants of the north who made a halt there when they came down for trade purposes.

Kulitalai is on the south bank of the river Cauvery and it is a variation of Kulithandalai [குளித்தண்டலை (சோலை)] "a grove in a low place." It is so even now.

Musiri on the northern bank, and opposite to Kulitalai lies in the centre of the north side of the district. It is said that it is called after Musiris a famous sea-port town on the Malabar coast, not far from Cranganore.

Perambalur. This name has led to many conjectures. The most ordinary is that it is a modification of Perumbuliyur (பெரும்புலியூர்) a village of large tiger. Even now cheetahs are found in the neighbourhood and cheetahs are easily mistaken for tigers. The

other story is that there was a saint known as Pulikkalmunivar (புலிக்கால் முனிவர்) and the five places where he worshipped God have reference to tiger (புலி) either from his size or from the place or from the tree under which he had worshipped. They are

1. பெரும்பற்ற புலியூர் (சிதம்பரம்). 2. திருப்பாபுலியூர் (கூடலூர்) 3. ஓமாம்புலியூர் (in South Arcot now) 4. காறுட்டான் புலியூர். (known as காறுப்பிரான் புலியூர்). 5. எருக்கத்தம் புலியூர் (Mudder plant). How far this may be correct, you may yourselves judge. The Saint himself obtained his tiger's legs from God to enable him to get up trees to get the necessary flowers for divine worship.

Udayarpalayam. We find names ending in Palayam (பாளையம்) throughout the district. It was Visvanatha Nayakan that introduced great administrative changes throughout his charge in 1560 and introduced the Poligar System under which the country was apportioned among a number of chieftains who were responsible for the well-being of their estates, paid him tribute and kept up a regiment of troops in a state of readiness for war. The places of encampment of the troops were called Palayams. But Udayarpalayam derives its name from Kachi Chinna Nallappa Kalappa Tola Udayar, a descendant of Ranga Udayar of Pallikonda, the founder of the family. Tola Udayar founded this town on the advice given in a dream by God Siva of Chidambaram about the year 1500. The present Zamindari is over 400 years old and is the most solvent of the eight or nine Zamindaris of Trichinopoly District. Names ending in Palayam are found throughout the district; and Karur Taluk alone contains so many as 51, chief of them being கல்லூர் பாளையம், மேலப்பாளையம், உப்புபாளையம்; கோவில், பாளையம், அரசன்பாளையம், சக்கரபாளையம். Musiri Taluk contains about 40, Lalgudi about 20 and Trichinopoly contains the least number of Palayams, regiments being required more in distant parts than in the neighbourhood of the metropolis.

Karur or Karuvuvur (கருவு ஊர்). This means "*embryo village*" and is due to the fact that God Brahma began his work of creation at this place. So it is sometimes known as பிரம்மபுரி. It is said that this was the capital of the ancient Chera Kingdom mentioned by Ptolemy, as no Chera records are found extant, it is doubtful if it ever were the Chera capital. There must have been another Karur on the west coast as the Chera capital. Karappuri (கரப்புரி) is another variation, which means a place on the borders of the three kingdoms of the Cheras, Cholas, and Pandyans. Tiru-a-nilai (திரு ஆநிலை) is another name of Karur

because of the lingam in the Siva Temple of Pasupateeswara. It was discovered by a cow which bathed the lingam with its milk. In this connection it may be mentioned that this district contains four temples which are called after the cow, the fly, the ant and the elephant for the honour paid to God by those beings. In the temple of திரு ஈங்கோய்மலை Agastyar is said to have taken the form of a fly in order to worship God, because the temple door was shut. Another is திருவானைக்காவு. Here an Elephant worshipped the linga under a Jambola tree along with a spider. Another in திருவெறும்பியூர் known as திருவரம்பூர் where an ant worshipped the lingam. Thiruthanthoni திருத்தான்தோன்றி known as திருத்தாந்தோணி means a lingam not made by man but sprang from the earth by itself.

Let me pass on to an analysis of the place-names and their suffixes. There are nearly 5000 villages in this District of which Kulitalai claims 1500, next comes Karur with 950 villages and Perambalur has only 350 villages. The names of these villages are derived in various ways.

Topographical. The ancient Tamilagam was divided into:— குறிஞ்சி, முல்லை, மருதம், பாலை, நெய்தல். Trichinopoly, being an inland District, has no sea-board and it has no desert areas. We have only villages situated on hill sides in pastoral tracts and in agricultural plains. The villages on the slopes of or near the hills end in குரிஞ்சி, குரிச்சி, குடி, குன்று, மலை, கிரி, as அணைக்குரிச்சி, மதனைக்குரிச்சி, நாச்சிக் குரிச்சி, திருவேங்கிமலை, இளங்காக்குரிச்சி, சேவ்குடி, காஞ்சிரிமலை. Those on the pastoral tracts with stretches of grass for grazing end in பாடி, பட்டி, சேரி, பேட்டை as சாத்தம் பாடி, மேட்டுப் பட்டி, பச்சரம் பேட்டை, வைரம்பட்டி, புல்லம்பாடி. Those on the plains near the rivers are fit for cultivation of fruit trees and paddy and plantains. They are very rich and populous and the names end in பட்டணம், நகர், ஊர், புரம், புரி, பள்ளி, சமுத்திரம், கோட்டை, and நத்தம், as மேட்டு நகர், பொன்னகர், கன்னிகோட்டை, கடவூர், மகமது புரம், மகமது பட்டணம், புத்தா நத்தம், உப்பா நத்தம், வாலிகண்டபுரம், வஷிட்டபுரம்.

Some names are derived from names of persons who founded them or lived in them. Most of them end in ஊர், பட்டி, புரம் etc. and the founders are mostly கவுண்டன், நாயக்கன், ரெட்டி, or தேவி such as in Karur taluk, முத்து நாயக்கனூர், ரெங்கப்ப நாய்க்கனூர், புதூர், பெருமாள்கவுண்டனூர், பழனிக்கவுண்டனூர், திம்ம நாயக்கன்பட்டி, ரெட்டியார் பாளையம், யாப்பிரெட்டியூர், திருமலைரெட்டி பட்டி, குப்புரெட்டிபட்டி.

தொட்டியபட்டி. சோளமாதேவி, பஞ்சமாதேவி, முத்தரசநல்லூர், சக்கிலிப் பட்டி, கபில மலை, ஆசாரிப் பட்டி.

Some places are called after agricultural or industrial products such as நெற் குப்பை (known as நெய்க்குப்பை) வரகூர், திருப் பயர், சோலைகொட்டியூர், சுண்டைக்காய் பட்டி, மஞ்சள் பட்டி.

Some places derive their names from the trees or plants that abound in the neighbourhood such as வேப்பந்தட்டை, பனையூர்ப்பட்டி. புளியம்பட்டி; ஆலம்பாடி; புரசம்பட்டி; விளாங்குடி, வில்வமரத்துப்பட்டி; ஈச்சம்பட்டி.

Some villages are known after the wild beasts or venomous reptiles which infested them such as பாம்பன் பட்டி, நாய் பாளையம், பெரும்புலியூர், புலிவலம், சிங்கப்பூர்; வேங்கைக்குறிச்சி, கரடிக்குளம்.

Some places have real historical associations and there are stone inscriptions found in the temples or in the neighbourhood to prove them. Such as, *Jayakonda Cholapuram* (that is, the city of of the victorious Chola) *Gangai Konda Cholapuram or Gangai konda puram* which was for over 100 years the capital of the Chola Kingdom in preference to Tanjore. The name means " The city of the Chola who conquered the Ganga." It was Rajendra Chola (1011-1044) who assumed this title in order to commemorate his northern conquests. It was founded by him between 1025-1032. It is now only an insignificant village but several traces of its departed greatness are still there, particularly the great Sivite Temple built exactly after the model of the Tanjore temple with the stone pyramidal tower and the bull. There is a story that the Ganges flowed into the temple-well in order to oblige the giant *Banasura* who ruled this place and had not leisure enough to go to the Ganges for his bath.

Valikandapuram and Ladapuram in Perambalur Taluk have some connection with the two ancient epics of Ramayana and Mahabaratha. Valikandapuram means the village where Vali (வாலி) was met and it is popularly supposed to have been the place where Rama met Vali, the monkey King, on the way to Lanka.

Ladapuram, 9 miles west of Perambalur, seems to be a corruption of Viratapuram which formerly belonged to King Virata

in whose country the Pandavas hid themselves for one year before the battle of Kurukshetra.

There is a certain suffix Mangalam (மங்கலம்) which is attached to many villages inhabited by Brahmins. It is said "Mangalam" means a gift made to learned Brahmins by Kings and Rajahs in those days so that they might live in isolation for advanced learning and contemplation. Not only in Trichinopoly but all through South India, you find places ending in Mangalam (மங்கலம்) reserved as the abode of learned Brahmins. This has been due largely to their deepest learning and highest culture. A few places that end in மங்கலம் are செட்டிமங்கலம், பாண்டமங்கலம், பணமங்கலம். கருடமங்கலம், அன்னமங்கலம். மகேந்திரமங்கலம். நரசிங்க மங்கலம். மும்முடி சோளமங்கலம். மேல சீதேவி மங்கலம்.

There are certain suffixes to names of places which I should think are peculiar to Trichinopoly. They are சங்கந்தி, மகாஜனம். கொம்பு (as in பண்ணுங் கொம்பு, முக்கொம்பு, கோம்பை) அழகிய மணவாளன்: இயம் (as in உடும்பியம், நொச்சியம் திண்ணியம்) அம்பில், வலசு (as in குமார வலசு), பெட்டுகட்டு and கொட்டம தனிஞ்சி, சிந்தாமணி.

It is for some of you to find out their true import and construct a history. Some towns have the prefix Tiru திரு or sri to show that they are holy and sacred and contain temples for the devout to go to. There are only 25 places in the whole district of which seven are found in Trichinopoly Taluk, 5 in Lalgudi Taluk; 4 in Udayarpalayam, 3 in Kulitalai, 2 in Karur, 2 in Perambalur, and 2 in Musiri. I should like to draw your attention to a few places which cannot be brought under any of the categories mentioned above as Tirupangili, ஞிலி means plantain tree which grows in the precincts of the Siva Temple. The Plantains are offered to the God and have to be thrown away afterwards. If any one eats the forbidden fruit, he is visited with a severe colic.

திருவெள்ளரை means only holy white rock—(அறை =rock.) They say that it contains 5 caves in a rock where the Pandavas lived while in exile. திரும்பராய் துரை—பராய் is the name of a tree under which God is worshipped on the bank of the Cauvery.

Gunasegaram. Otherwise called Gunasilam. The name is supposed to be drawn from that of the sage Gunasilam who is supposed to have lived there. There is a temple dedicated to வெங்கட்டரமண சுவாமி built by Dharmavarma of உறையூர்.

Some familiar names I have not dealt with at all as Srirangam, Mahadanapuram, Samayapuram, Nangavaram, Pattavaithalai. These are all names with which we are more familiar. Of the five thousand villages in this District only one is a city and about half a dozen may be called towns . The rest are all villages. What does it mean ? Real life in India is the rural life in villages and the Indian life flows through the villages.

The Cauvery Delta and the Kallas

By

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The Cauvery Delta occupies a unique place in the historical Geography of South India. The green fertility of the delta is in striking contrast to the arid unpicturesqueness of the surrounding tracts. Luxuriant crops stretch as far as the eye can reach, and the view is being interrupted only by rich groves of cocoanut and other fruit trees, while numerous rivers and streams full from bank to bank pass onwards to the sea at frequent intervals. Not without reason was this charming land of paddy the home of the Tamilian culture and the seat of several powerful dynasties as the Indo-Gangetic plain was in Northern India.

Not only was this the most highly-prized food-producing plain country but was also most favourably situated in regard to contact with the outside world. In the eastern coast of this delta there are eighteen small harbours as noticed in the Tanjore District Gazetteer. Extensive maritime trade was carried on by the ancient Tamils in horses and precious metals with Arabia, in pepper, sandal, 'ahil' and pearls with the southern and the western coasts and in all kinds of food and manufactures with Burma and Ceylon. The palaces of the kings have been most extravagantly praised by the poets.

But the significant fact about this agricultural and maritime civilisation of the Tamils of the Delta was that the country was entirely defenceless and was unprotected by any natural frontiers. It was therefore the scene of frequent wars and invasions and in a sense it may be called the cock-pit of Southern India.

"Paddy" and "insecurity"—the two outstanding facts of physical geography—perhaps sum up the social, the economic and the political history of this region and of the communities that have inhabited it. I have therefore borne these two fundamental facts in mind in this study of the Kalla community.

Who are the Kallas ? Unfortunately no conclusive answer can be given to this simple question. Widely divergent views have been expressed by competent authorities. Some have held the view that they are the descendants of the ferocious Nagas, who held sway over the primitive peoples of this region before the advent of the mighty Cholas, and others have put forward the theory that they are the descendants of the Pallavas ; while a few others would consider them as an indigenous tribe which had inhabited the ancient district of " Tondaimandalam," and subsequently had emirgrated into this fertile area.

No doubt their primaeval occupation was marauding, and like the Northmen of Europe, they would have made a living by plunder and booty. When they penetrated into this rich agricultural region, they easily made themselves lords of the soil subjecting the primitive agricultural and pastoral tribes into a sort of servitude. Surely there was developing a kind of feudal relationship between the Kallas and the rest.

But, as we have noticed already this was a land of insecurity. Incursions by new and fresh tribes ought to have been numerous, thus giving a fillip to the growth of feudal ties. It is interesting to note that scores of villages have been named after Kalla chieftains whose caste titles are still current. As for instance, to mention only a few, " Kangayan-patti," " Cholagan-patti," " Sethirayar-kudi-kadu " etc. Necessities of defence led to the erection of earthern mounds in several villages, ruins of some of which are said to be seen even to-day. Hence the names of places such as " Palapatran-kotai," " Kandar-kotai," " Killi-kotai," " Pattalan-kotai," " Malla-kotai," " Chatrusankara-kotai," " Pudukotai," etc.

With the establishment of a strong monarchy, the territorial, jurisdictions of these feudal magnates were certainly curtailed, but since the country was always exposed to dangers and incursions on all sides, the services of the Kallas and their Chieftains were indispensable not only for defences but also for administration of justice and the maintenance of law and order. Here again the analogy of political feudalism as it developed in Europe in the ninth and the tenth centuries holds good. Such ought to have been the origins of the famous " *Kaval* system," relics of which are to be seen even to-day in several parts of the Cauvery Delta.

The *Kaval* system is described as follows in the Trichinopoly Gazetteer. It is a relic of the old native regime where it was cus-

tomary to hand over police duties (*Kaval*=watch and ward) to members of the most criminal tribes. The *Kaval* system was controlled by *Arasu Kavalgars* and the *Arasu Kavalgar* of Pudukotah was the Raja himself. The *Kavalgars* exacted fees from the people which varied according to the nature of the services rendered. Besides these fees, they were given *inam* lands (rent-free lands) by the Kings. " Indeed most of the poligars scattered about South India at that time seem to have held their estates partly on *Kaval* tenure and were responsible for law and order within them." By about 1850, the British government resumed several of these *inams* and ordered the levy of *Kaval* fees to be discontinued. Some of the larger *Kavalgars* were pensioned off.

This brief historical account brings out one or two salient facts about the Kalla community. Though the Kallas were in the midst of a rich and prosperous region, they never cared to cultivate the soil. At present there are eleven Kalla Zemindars one ruler with sovereign powers (the Rajah of Pudukotah) and a good many pucca landlords, but the bulk of the community, for the reasons stated above, is poor, landless, and in certain places of the Trichinopoly District, still making a living by thieving and blackmailing. A contrast with the peaceful agricultural class, like the Vellalas, is indeed very striking.

The Maravas of the Tinnevelly and Madura districts with whom the Kallas of the Cauvery Delta have close kinship, were not fortunate in having possession of a rich and fertile region as this, and yet the tribal characteristics and propensities of the Kallas have undergone no variation and the fortunes of both at the present time are almost the same.

A Note on the Communication Lines of the Trichinopoly District

By

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The District of Trichinopoly, like the District of Coimbatore, occupies a " Key " position in South India. Its central location, between the deltaic district of Tanjore in the East and the riparian districts of Coimbatore and Salem in the West and between the Northern and the Southern sections of the Karnatic plain, has led to the convergence and crossing of important East-to-West and *North-to-South routes at the two nodal towns* of *Trichy and* Karur.

The Cauvery valley is the main artery of East-to-West communication in the district. Along the south bank of the river through the ribbon of fertile irrigated region runs the railway from Erode to Trichy, linking up the two main lines of the South Indian Railway the broad gauge and the metre gauge. Practically along side of it runs the road between the same two places, both the rail and road crossing the Amaravathi at Karur by bridges.

Along the north bank of the Cauvery also runs a road from Lalgudi through Musiri to Tottiyam, whence it strikes north-westwards to Namakkal and Salem, while from Lalgudi in the East it turns north-eastwards to Udayarpalayam and Chidambaram. This oblique trend at either end of the road is partly explained by the location of the Kollimalais and the Pachaimalais in the North.

The main metre gauge railway line from Madras to Rameswaram ran till recently through Tanjore and Madura ; but the chord-lines from Villupuram to Trichinopoly and from Trichinopoly to Manamadura have helped to shorten this railway journey considerably. The trunk road from Madras, which passes through Vriddhachalam and Perambalur, crosses to Trichinopoly by bridges over the Coleroon and the Cauvery on either side of Srirangam island.

From Trichinopoly two alternative routes diverge to Madura—one of them following the railway line via Dindigul and the other passing through Pudukkottah and Melur to the east of the Sirumalai Hills which separate them.

From Manapparai in the South curves out a big loop road, crossing the Cauvery bank roads at the twin towns of Kulittalai and Musiri, and running through Turaiyur, Perambalur and Ariyalur to meet the Lalgudi—Udayarpalayam road in the north-east of the district.

Besides the West-to-East road from Erode to Trichinopoly already mentioned, other important roads diverge from Karur—south-westwards to Dharapuram and Kangayam, and thence to Pollachi, Coimbatore and Palghat, and south-eastwards to Dindigul, Madura and Tinnevelly.

Corresponding to Karur in the West of the District, Trichy in the East of it is another great focus of routes, which diverge in all directions. Besides being a great railway and road centre with the famous Golden Rock Workshop in the neighbourhood, Trichy has an aerodrome, and will soon be an important air-centre when the Indo-Ceylon connection is carried out.

Except the road and railway bridges already mentioned, there is none other over the whole length of the Cauvery within the district for ordinary road traffic. Hence, coracles of wicker-work lined with hide are used in flood-time at important crossings; while, in summer the loose sand is scraped out at such crossings on either side of the foot-path, so that pedestrians can walk comfortably on the wet sand even at mid-day.

It is pleasing to note that in spite of the heavy traffic the condition of the roads is generally satisfactory, due partly to the hard bed-rock in most parts of the district and partly to the easy availability of gritty road metal.

FIG. 28.

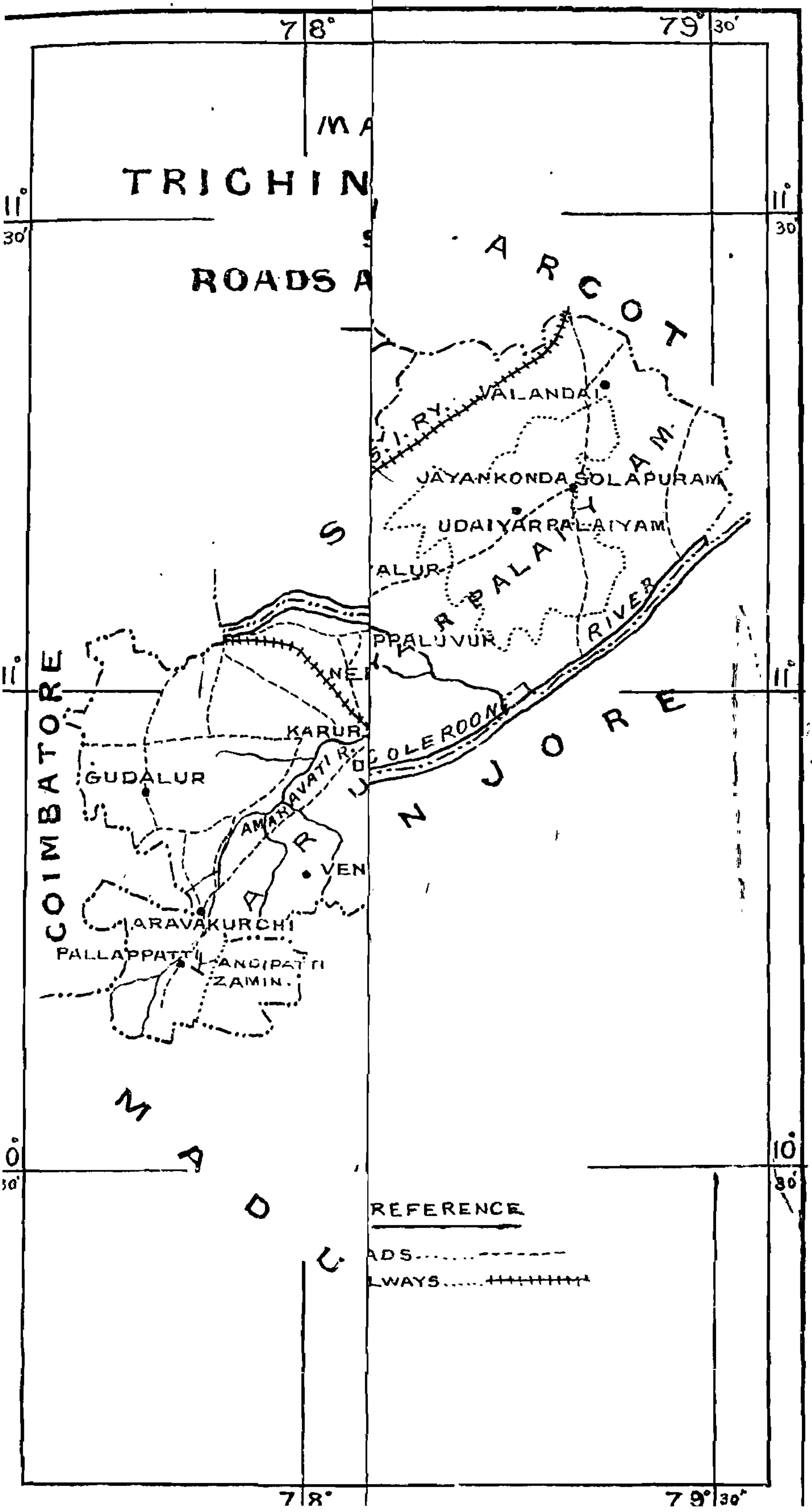
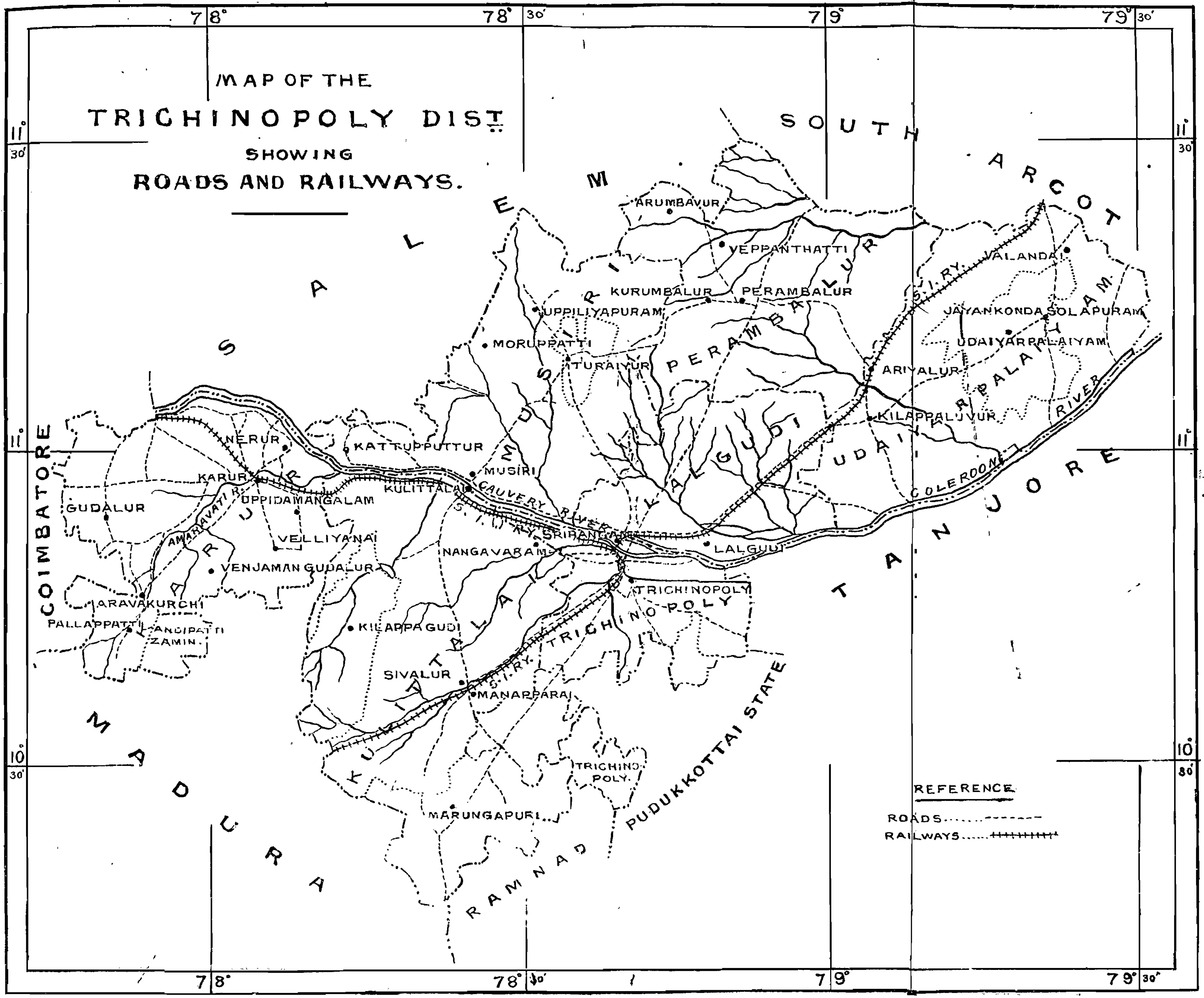

TRICHIN
ROADS A
ARCOT
S.I.RY.
VALANDAI
JAYANKONDA SOLAPURAM
UDAIYARPALAIYAM
ALUR
PPALUVUR
RIVER
NE
KARUR
COLEROON
AMARAVATI R.
GUDALUR
COIMBATORE
TANJORE
VEN
ARAVAKURCHI
PALLAPPATTI
ANDIPATTI ZAMIN.
MADURA
REFERENCE
ADS
LWAYS

FIG. 28.


MAP OF THE
TRICHINOPOLY DIST.
SHOWING
ROADS AND RAILWAYS.
SOUTH ARCOT
SALEM
COIMBATORE
MADURA
TANJORE
RAMNAD
PUDUKKOTTAI STATE
PERAMBALUR
MUSIRI
LALGUDI
UDAIYARPALAIYAM
KARUR
KULITTALAI
TRICHINOPOLY
ARUMBAVUR
VEPPANTHATTI
KURUMBALUR
PERAMBALUR
UPPILIYAPURAM
MORUPPATTI
TURAIYUR
JAYANKONDASOLAPURAM
UDAIYARPALAIYAM
VALANDAI
ARIYALUR
KILAPPALUVUR
NERUR
KATTUPPUTTUR
MUSIRI
KARUR
KULITTALAI
UPPIDAMANGALAM
GUDALUR
VELLIYANAI
SRIRANGAM
LALGUDI
NANGAVARAM
VENJAMAN GUDALUR
ARAVAKURCHI
PALLAPPATTI
ANDIPATTI ZAMIN.
KILAPPAGUDI
SIVALUR
MANAPPARAI
MARUNGAPURI
TRICHINO POLY.
CAUVERY RIVER
COLEROON RIVER
AMARAVATI R.
S.I.RY.
REFERENCE
ROADS
RAILWAYS
78°
78° 30'
79°
79° 30'
11° 30'
11°
10° 30'

Fairs, Festivals and Shandies in the Trichy District

By

Mr. V. Krishnan M.A., Dip. (Econ.) Dip. (Geog.)

In an agricultural country like India where the people live in the villages far removed from towns, the peasants live in close dependence on the soil in small mud huts. The state of agriculture being in the subsistence stage and the method of payment of wages being in kind in many tracts, every peasant has something to dispose of and has some small wants to satisfy. As a result, therefore, some intermediaries have developed between the bazaars of the towns on the one hand and the village shops on the other. This institution called the 'Weekly shandy' in South India plays an important part in the life of the people. The smaller number of permanent rural shops when compared to the total rural population is due mainly to this phenomenon of weekly shandies or markets.

These shandies are held on different days of the week and there are 3 types of these congregations. The bigger annual fairs are held in places once or twice or more in connection with some big festivals which are periodical in character. 'The Annual Fairs' are held once a year either in connection with some festival when there is likely to be a huge crowd or simply after the harvest on some auspicious days in the year like Panguni Utram, Arpasi Vishu, Thai Amavasai, Chitra Vishu and Chitra Pournami. The influence exerted by the annual fairs may be small or large according as the crowd gathered is from narrower or wider area. The third type is much more numerous of the 3 types, and these primary markets exert a tremendous influence on the political, economic and social life of the people. The essential function of the weekly market is one of exchange. Almost the whole of the commercial life of the people takes place there. The size of the shandy varies according as the volume of trade is large or small. All the shandies have some sort of enclosed area where people assemble. For assembling within the compound a rent is

paid generally. Permanent structures are not put up in all shandies.

The first two types are bigger in size than the third and the circumstances under which they are held are also different from those of the other. The festivals are held once or more than once depending upon the wealth of the temple. These occasions are used for drawing together the neighbouring population. The time when these festivals fall happen to coincide with the off-season of the agriculturist, so much so, the ryots come to the festival not only to worship the deity but also to dispose of their products at a fair price.

The frequency of the months when the festivals are held is as follows: —

January 2	May 2
February 3	August 1
March 1	October 1
April 13	December 2

In this region the month of April happens to be the off-season after harvest; and the ryots then will have some leisure which they utilize in going on pilgrimage to places nearby. The Tamil New Year's Day (Chitrai Vishu) falls in that month and connected with that, various temples organise different festivals. Highly religious as the Hindus are by nature, they are drawn by these festivals to a particular centre, where they bring with them their wares to be disposed of. On such occasions they not only worship the deity and bathe in the sacred waters (Thirthams) in different centres but also sell some of their produce.

Such congregations of people afford a good market for the selling of the produce of the ryots and the small industrialist. The dealers in bronze and brassware, the glass-bangle sellers and the dealers in fancy goods like mirrors, combs, various kinds of rubber goods and toys never fail to visit a single festival centre. The shops of these travelling dealers remain longer than the actual duration of the festival. Though the actual duration of the festival may be 10 days the small dealers stay there for more than a month, supplying the rural folk of the neighbourhood with the

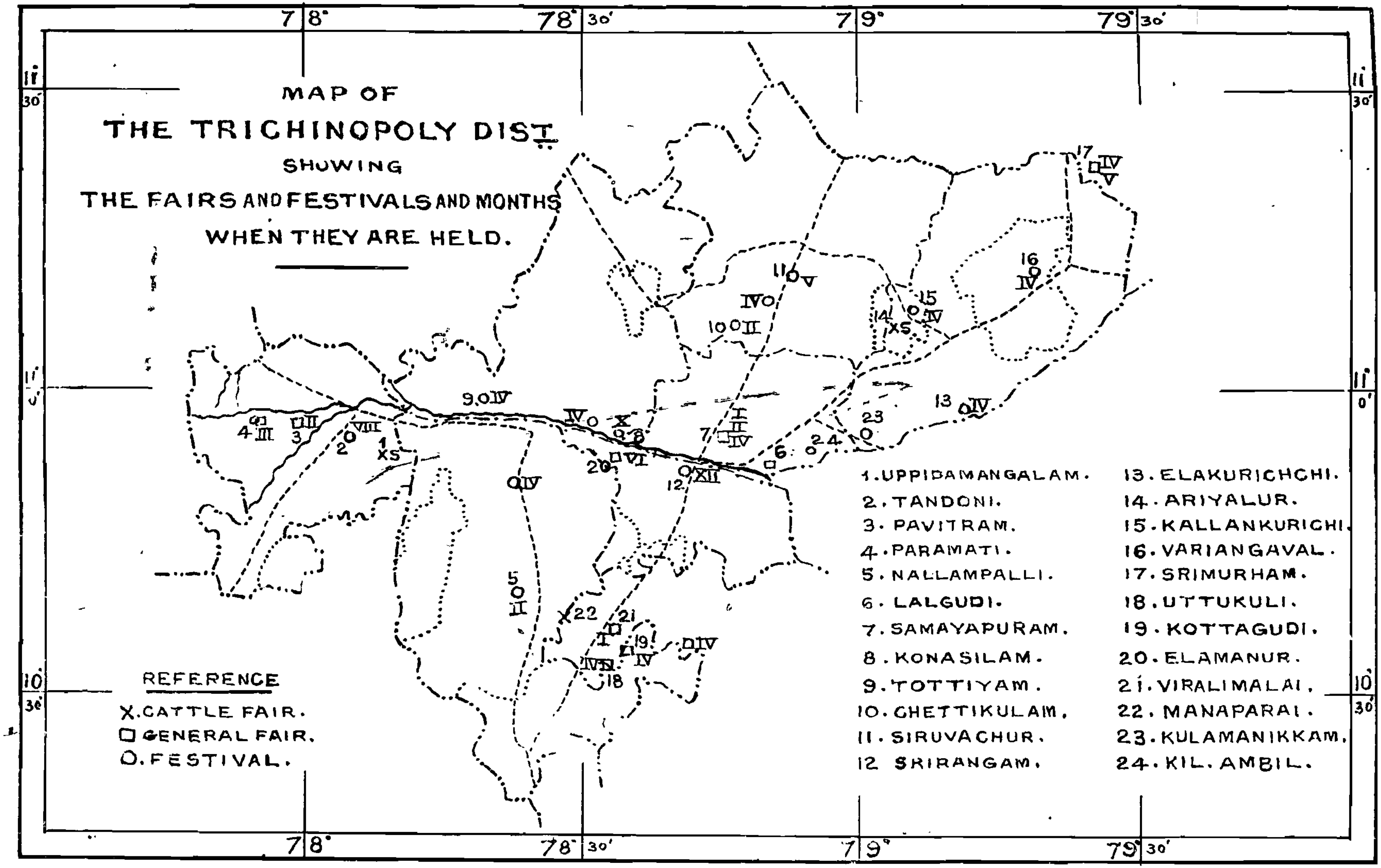
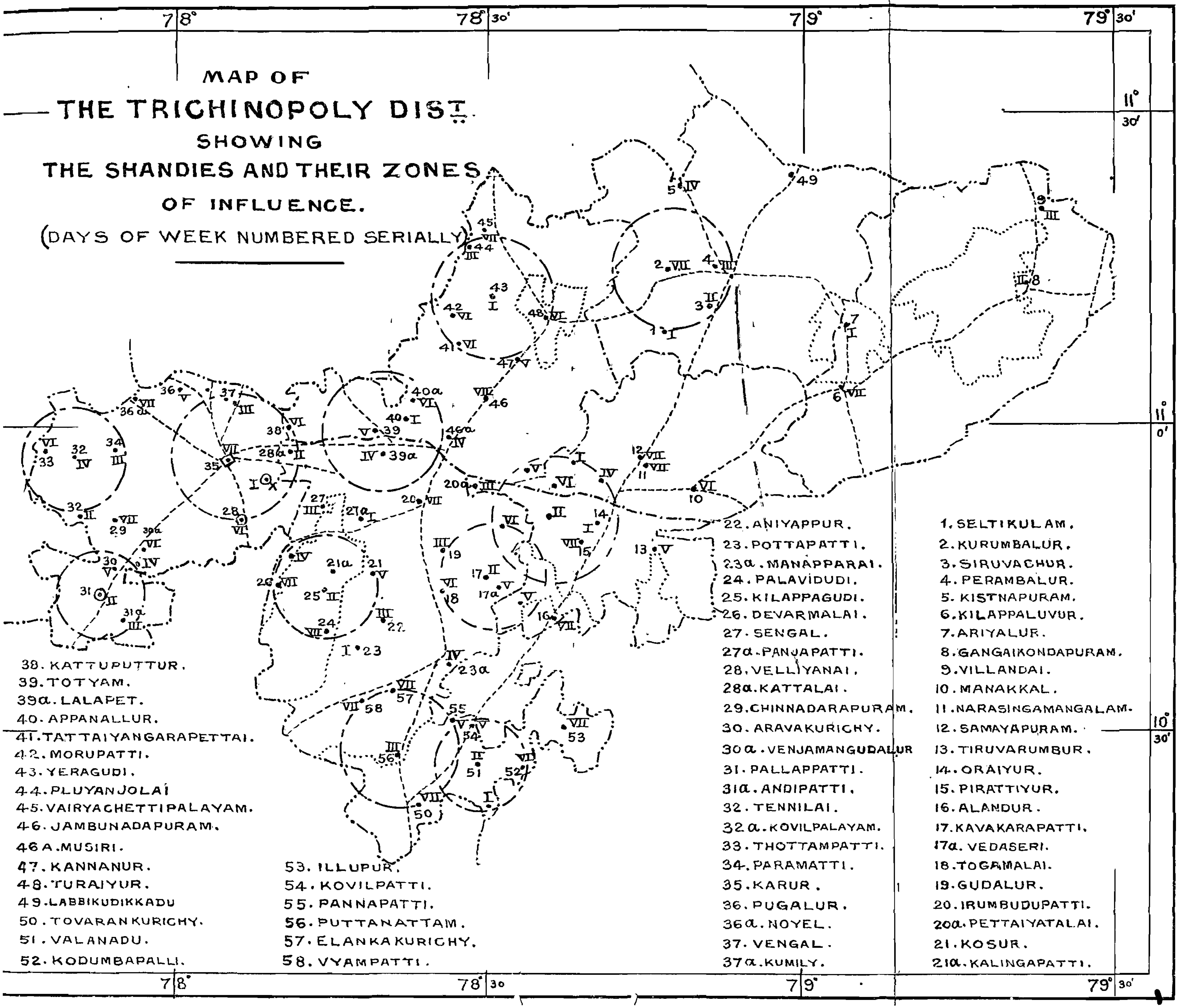

MAP OF
THE TRICHINOPOLY DIST.
SHOWING
THE FAIRS AND FESTIVALS AND MONTHS
WHEN THEY ARE HELD.
1. UPPIDAMANGALAM.
2. TANDONI.
3. PAVITRAM.
4. PARAMATI.
5. NALLAMPALLI.
6. LALGUDI.
7. SAMAYAPURAM.
8. KONASILAM.
9. TOTTIYAM.
10. CHETTIKULAM.
11. SIRUVACHUR.
12. SRIRANGAM.
13. ELAKURICHCHI.
14. ARIYALUR.
15. KALLANKURICHI.
16. VARIANGAVAL.
17. SRIMURHAM.
18. UTTUKULI.
19. KOTTAGUDI.
20. ELAMANUR.
21. VIRALIMALAI.
22. MANAPARAI.
23. KULAMANIKKAM.
24. KIL. AMBIL.
REFERENCE
X. CATTLE FAIR.
□ GENERAL FAIR.
O. FESTIVAL.
78°
78° 30'
79°
79° 30'
11° 30'
11° 0'
10° 30'

FIG. 30.



MAP OF
THE TRICHINOPOLY DIST.
SHOWING
THE SHANDIES AND THEIR ZONES
OF INFLUENCE.
(DAYS OF WEEK NUMBERED SERIALLY)
78°
78° 30'
79°
79° 30'
11° 30'
11° 0'
10° 30'
1. SELTIKULAM.
2. KURUMBALUR.
3. SIRUVACHUR.
4. PERAMBALUR.
5. KISTNAPURAM.
6. KILAPPALUVUR.
7. ARIYALUR.
8. GANGAIKONDAPURAM.
9. VILLANDAI.
10. MANAKKAL.
11. NARASINGAMANGALAM.
12. SAMAYAPURAM.
13. TIRUVARUMBUR.
14. ORAIYUR.
15. PIRATTIYUR.
16. ALANDUR.
17. KAVAKARAPATTI.
17a. VEDASERI.
18. TOGAMALAI.
19. GUDALUR.
20. IRUMBUDUPATTI.
20a. PETTAIYATALAI.
21. KOSUR.
21a. KALINGAPATTI.
22. ANIYAPPUR.
23. POTTAPATTI.
23a. MANAPPARAI.
24. PALAVIDUDI.
25. KILAPPAGUDI.
26. DEVARMALAI.
27. SENGAL.
27a. PANJAPATTI.
28. VELLIYANAI.
28a. KATTALAI.
29. CHINNADARAPURAM.
30. ARAVAKURICHY.
30a. VENJAMANGUDALUR
31. PALLAPPATTI.
31a. ANDIPATTI.
32. TENNILAI.
32a. KOVILPALAYAM.
33. THOTTAMPATTI.
34. PARAMATTI.
35. KARUR.
36. PUGALUR.
36a. NOYEL.
37. VENGAL.
37a. KUMILY.
38. KATTUPUTTUR.
39. TOTYAM.
39a. LALAPET.
40. APPANALLUR.
41. TATTAIYANGARAPETTAI.
42. MORUPATTI.
43. YERAGUDI.
44. PLUYANJOLAI
45. VAIRYACHETTIPALAYAM.
46. JAMBUNADAPURAM.
46A. MUSIRI.
47. KANNANUR.
48. TURAIYUR.
49. LABBIKUDIKKADU
50. TOVARANKURICHY.
51. VALANADU.
52. KODUMBAPALLI.
53. ILLUPUR.
54. KOVILPATTI.
55. PANNAPATTI.
56. PUTTANATTAM.
57. ELANKAKURICHY.
58. VYAMPATTI.

necessary bronze and brassware and fancy goods which may not be available in the villages.

After a festival is finished in one centre, the dealers migrate to another place of festival. Thus from Pavitram (festival in February) they go to Paramatti in March for the festival there, thence to Tottiyam for the Madurai Kaliamman festival in April and return back after visiting the important villages on the way. They reach their native villages when the agriculturist is busily engaged in his planting and sowing operations. During that period no important festival is held anywhere. After April the festivals are held either in August or September after the second harvest is over in those places where there are two crops.

The festivals, so to say, influence the life of the people of the region. The off-season of the agriculturist is the busy season for the small itinerant traders, more especially the bangle vendors.

Connected with all these festivals, cattle fairs are held. These fairs serve as clearing places for the old used cattle of the ryots and the new stock brought by the traders from the breeding areas in Salem and Coimbatore which supply the whole of the southern districts with draught cattle. The cattle are led along the famous cattle route to Madura attending important fairs on the way. Though cattle trade with its manifold intricacies is a tempting topic for discussion, in this paper it may not be appropriate.

The location and the distribution of the fairs throw an important light on the Geographic factors necessary for the holding of cattle fair. The fairs are situated near the water sources along the bank of the river or near a tank as in Chettikulam where there is enough space for stalling the cattle. Generally there is no permanent shed for shade, but the cattle are exhibited under trees and if it rains there may not be a good collection of cattle. So the cattle fairs are held in such of the months when under normal circumstances there may not be any rain as in April and May as far as Trichinoply District is concerned. In some places like Manaparai which is on the famous cattle route to Madura and Dindigal and further south, cattle fair is held every week, though other products also are brought for sale.

The size and duration of these cattle fairs depend on the total number of people that are likely to gather in a festival and

the number of times the fairs are held in the year. Thus the Ariyalur and Manaparai cattle fairs which are held more frequently are smaller than the one at Samayapurm where a big fair is held in February and continues up to April every year. Though situated far away from the Cauvery, it is near the Uppar river, another water source along the course of which some cattle fair centres are found.

The primary market or shandies seem to be far and away the most important in the life of the people of this region. There are some 60 shandies in this district held on different days of the week. Out of these 60 shandies, 20 shandies are held on Saturdays, 9 shandies on Fridays, 10 shandies on Thursdays, 6 shandies on Tuesdays, 7 shandies on Wednesdays, 3 shandies on Mondays and 12 shandies on Sundays. The larger number of shandies on Saturdays may be explained by its being a " கழிவுநாள் " (Kazhivu Nal) according to Hindu religious convention, when one may not be willing to perform any auspicious thing. As the people will then have greater leisure than on other days, they may go to the shandy to make purchases. The influence of religion in determining the day of the week when the shandy is to be held is brought out by the fact of Perumbalur and Udayarpalayam Taluks with large number of Muhammadan population, having their shandy on days other than Fridays which are prayer days for them. In the Trichy taluk, though there is a larger number of Muhammadans than in the above taluks, the Friday shandies may be explained by the higher commercial character of the taluk and greater influence of the metropolis of the District.

The shandies are distributed along particular lines of communication. All along the course of the River Cauvery there is a string of shandies on both its banks where the river is fordable like Tottiyam and Lalapet and Kattupattur and Kattalai. The location of the shandies at these places may be due to the high fertility of the area adjoining the river and hence greater productivity and also due to these places being natural concentration points for the commodities of the neighbouring villages to cross the river. Like the gap towns of the Madura district Andipatti and Usilampatti, enjoying natural advantages for the location of the markets at those places, the river towns of the Trichinopoly District enjoy the advantages for the collection of the products and so shandies have grown up there.

Another string of markets is located higher up away from the Cauvery valley North and South at the junction of roads. Such shandies have the advantage of nodality.

An interesting feature about these shandies is that they are situated near water sources as in Vallanadu and Panjapatti. With many of these shandies are combined cattle sections, which may be small or large. The ryots purchase their plough oxen in these weekly shandies.

These shandies have got definite zones of influence. In the more fertile tracts the area served by a shandy is less than that in the drier area. In certain places where there is a big shandy which also happens to be a good collecting centre of the products of the neighbourhood, the zone of influence of that particular shandy is felt over a wider area; and there is a general absence of shandies for miles round it. The Karur shandy is a case in point. In the drier parts of the Musiri, Karur and Udayarpalayam taluqs there seems to be a general deficiency of shandies. In the wet tracts the over-lapping of the zones indicates the general adequacy of the shandies.

The weekly shandies in addition to their being centres of exchange of commodities also give scope for professional men like the barbers, and village artisans and craftsmen to pursue their calling. Since the shandies are held on different days of the week fairly near to each other, these artisans and craftsmen who are of the itinerary type go from shandy to shandy and reach the starting place after a week's circuit.

The same may be said about the traders whose occupation is to go from shandy to shandy to dispose of their goods reaching the place of starting after a week. Thus the weekly shandies like the fairs and festivals exercise a definite influence on the life of the people engaged in the rural trade and on professions and crafts like barbering, carpentry and smithy work. The credulity of the rural folk that come there has given rise to a travelling band of fortune-tellers drawn from the different castes. The Hindu Korava women (basket-makers) and the Muhammadan Fakirs are the inseparable elements in connection with the weekly shandies.

To conclude: in a predominently agricultural country like India these weekly shandies have a great deal of potential import-

ance. These may serve as places for conducting propaganda work of different kinds. Since most of the congregation in the shandies come from the villages and since they are also actually connected with agriculture, for rural development and reconstruction purposes these shandies may be used as the media for the diffusion of knowledge about various improvements effected by the various Development Departments.

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The Geographical Basis of the Indian Iron and Steel Industry

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INTRODUCTION

Iron and steel industries form the basic industries of any nation. Their importance has been well brought out during the recent World War of 1914-18; and as such the establishment of these industries at those places where natural conditions are favourable, or where even though raw materials have to be brought from elsewhere, other conditions are favourable for the successful establishment of the industry, (as in Cleveland, Buffalo, etc.) has been receiving the attention of people. The extent to which iron enters into the life of the people cannot be adequately described and is best left unsaid. From the commonest nail, wire, needle etc., to some of the most highly specialised and costly priced articles such as some of the modern high speed tools are either made of iron, steel, or of alloys of which iron is an important constituent. The utility of iron and its popularity are the results of its wide occurrence, its abundance (because it forms one of the most important constituents of the material of the earth) and hence its cheapness, and its characteristics both physical and chemical which render it capable of being used for an innumerable variety of purposes. (Man began to realise the usefulness of iron at an early stage in his history on earth; and hence it is that succeeding the Neolithic age we have the Iron age.)

The position of India in the iron industry of the world has been one of importance from very early times. The numerous slag heaps scattered throughout the country, bear testimony to the once prosperous iron smelting industry in this country. Indian wrought iron has been considered to be one of the best of its kind as is evidenced from the fact that the engineers concerned in the construction of the tubular iron bridge across the Menai Strait gave preference to the malleable wrought iron prepared in India. This high quality was attained not only in the case of wrought iron, but also in the case of steel. The famous 'Wootz' of Salem and some other parts of the Madras Presidency have been acclaimed to be the best of its kind ever produced. The high quality of the metal produced in India can be traced to the methods of production which involved the use of charcoal for reduction. (By trials it has been found that the excellence of the quality of the charcoal reduced iron cannot be equalled by the metal produced by using coke). The preparation of this was an important branch of the metallurgical operations in India.

DISTRIBUTION

The reason for this wide distribution of iron smelting industries in India can be traced to the distribution of iron ore in India.

Iron forms an important constituent of the igneous rocks; and this richness in iron manifests itself in their ferruginous minerals, oxides as well as silicates. Thus iron is almost always present in igneous rocks, and is found associated with sedimentaries derived from them. Peninsular India except for local exceptions is almost wholly composed of the igneous and metamorphic rocks of the archaean and dharwar systems (banded quartz-haematite and quartz-magnetite schists form an important type of rock in the dharwar system); and the wide occurrence of the rocks of these systems would serve to explain the indulgence of the natives in iron smelting operations.

Besides the archaean and the dharwar systems, the peninsula is composed of sedimentary rocks that have been derived from the surrounding archaean and dharwar rocks mostly, together with igneous intrusions. The Cuddapahs and the Vindhyans are the oldest of these (barring the dharwar). Quartzites, the most common rock type of the Cuddapah system very often contain

inter-stratified iron and manganese deposits (as in some parts of the Cuddapah and the Kurnool districts of the Madras Presidency).

The gondwanas, economically the most important rock formation in India, contain in the Iron stone shales of the Damuda series a valuable source of iron ore. The laterites, which are of such wide distribution in India, contain in their ferruginous varieties another source of iron ore, which has been much speculated upon. The gravels and sands of the bed of the rivers draining the metamorphic regions of India are another source of iron ore.

Regionally considered iron ores have a wide distribution in India, which is the result of the wide distribution of the archaean and dharwar rocks. The more important of the several occurrences and those that have been the object of attention and have been investigated on a practical scale are the following: —

(1) Iron ores of Salem District,
(2) Iron ores of the Iron belt of Bihar and Orissa,
(3) Iron ores of Kumaon,
(4) Iron ores of Birbhum,
(5) Iron ores of Chanda and Drug Districts,
(6) Iron ores of the Bababudan Hills.

SALEM DISTRICT

The iron ores of Salem District, magnetitic in composition are one of the largest ore bodies in the world and has been the subject of investigation for a long time past. The ore bodies are noted not only for their size but also and more for its richness. This richness in quantity and quality has been the driving force for the repeated attempts at their utilisation. Samples of them are sent to the Imperial Institute of London and analyses have pronounced them to be unfit for use in the blast furnaces of the present day. The chief drawback of this area has been the fuel problem. The ores lie in a region of crystalline rocks of extreme antiquity with no inliers of younger sedimentary rocks so that there is not the least hope of coal being ever found here. The question of freightage would kill any attempt at their utilisation with the help of the Bengal coal.

HAEMATITE

It is the haematite ores of India that are at the present day the basis of the Indian iron and steel industry. They are, unlike the magnetite deposits, of wide distribution in India. The most noted and the largest ore body of this kind is the one occurring in the province of Bihar and Orissa and the adjoining native states. This occurrence in the hilly forested region of Bihar and Orissa is noted not only for its size but also for its high quality in both of which respects it far surpasses the much better known occurrence of haematite in the Lake Superior region of America. This extremely rich iron deposit is situated 150 to 200 miles west of the port of Calcutta, and extends over the Singhbhum district of Bihar and Orissa and the feudatory states of Bonai, Keonjar and Mayurghanj, while recent surveys point to their extension in other states also. These occurrences may together prove to be the largest and the richest in the world. The ore usually caps the tops of mountains in Jamda (Singhbhum Dt.) but in parts of Keonjar State they are found at lower levels and even in the plains. The most important of these occurrences is the range starting from near Kompilai in the Bonai State and continued in a N.N.E. direction to a point 3 miles S.W. of Gua, the length of the whole range being about 30 miles. Running parallel to this and possibly faulted from them are other ranges of lesser elevation, which contain ore. The main range has an average elevation of 1,500 feet and the average width of the outcrop is about 1,000 feet.

The quantity of ore which this ore body contains is much larger than that in the case of the Lake Superior region. The average iron content is over 60 per cent (in Lake Superior region 40 per cent to 50 per cent). It is only recently that this has received the attention of people and hence has not been developed to such an extent as that of the Lake Superior region where modern iron smelting was of earlier advent, is more highly developed and is on a larger scale. Since the discovery of the extraordinary richness and the large size of the ore body, there has been a rapid development of it, simultaneously with the advance of modern processes of iron manufacture leading to an increased production of iron.

The seeds have been sown for an industrial India, and the Iron belt which has fostered it has promises of maintaining it for a long time.

The other notable occurrences of haematite in India are those of the Chanda and the Drug districts and the Mysore state. Of these the last one alone is of importance at the present day.

MYSORE

The iron ores of Mysore are of special importance to India as being the basis of the Mysore Wood Distillation and Iron Works, the premier one of its kind in the British Empire and the only one in India. Iron ore is widely distributed throughout the native state of Mysore (and the wide distribution of slag heaps may be said to be a result of this); but there is a remarkable concentration of it in the Shimoga and the Kadur districts. This ranks as one of the most important iron ore deposits of India. Large deposits of iron ore (esp. haematite schists, earthy haematite and limonite) are found as a capping on the eastern flanks of the Bababudan hills (in the vicinity of Kalhatti and Kemmangudi). The iron content varies from 53 to 64 per cent. The ores extend along the top of the hills for 2½ miles in a north-westerly direction from Kalhatti village. The ores are mostly haematite and limonite. They are well situated for exploitation and the Mysore Government has launched on a large scale experimental enterprise the manufacture of iron by modern methods.

KUMAON

The iron ores of Kumaon also belong to the haematite class of ores. There are 4 distinct areas here and the ores vary much in composition.

GOA.

In the vicinity of Goa there is an occurrence of iron ore again which should receive the attention in the days to come. Its situation within 4 miles of a navigable harbour, its high grade, low percentage of silica and phosphorus are particularly to be noted (as being iron ores capable of being handled by modern methods).

GWALIOR

In Gwalior again there is an abundance of iron ores which were formerly extensively mined but which have now been given up on account of the increasing distance over which the ore had

to be transported to the blast furnaces situated near the sources of fuel. The principal occurrences are (1) Par Hill, (2) Mangor and (3) Santow.

CLAY IRONSTONES

There are two important occurrences of ironstones in India, in the Raniganj coalfield and in the coalfields of Assam.

In the Raniganj area the beds containing the ironstone are of inconstant thickness and extend for over 33 miles from east to west and with an average width of 12 miles. The reserves are variously estimated (200 million tons to 6.4 million tons per sq. mile). On an average the ores contain 38.92% of iron 2.09% of phosphoric acid and traces of sulphur.

The ores were the basis of the Barakar Iron Works at Kulti for several years up to 1906 when these were abandoned in favour of the richer Kolhan ores.

The iron ores of Assam are clay ironstones taken from the coal measures and an impure limonite from the sub-Himalayan strata. The iron ores of the coal measures contain on an average about 40% of iron while favourable samples of the sub-Himalayan regions yielded from 35.2% to 32.6% of iron, but the average is considerably less.

The ores of the coal measures are not in sufficient abundance to afford a supply to a modern blast furnace, while that of the sub-Himalayan strata, though practically inexhaustible are too poor in quality.

LATERITIC ORES

Large spreads of ferruginous laterite often with 30% of iron are found from the Rajmahal hills to the Ratnagiri and from Central Indian highlands to the Carnatic plains of Madras. The laterite deposits of Birbhum had been the object of attraction. The ore occurs at the base of laterites but they do not seem to be of constant thickness for long distances. It has been fairly established however, that the ore is abundant and that it contains a high percentage of iron often as high as 60%, but generally it averages about 40%. But the richer and the better situated hæmatite deposits have thrown this to the background.

Such a wide distribution of good quality iron ores would naturally lead one to expect a prominent position for iron smelting operations in the industries of the country. The surmise would not altogether be wrong, for in the days gone by and till a few decades ago, India did give a prominent position for her iron smelting industry.

Before the introduction of modern industrial methods of production, the Indian iron smelter had reached a very high standard of perfection. Mention has already been made of the preference given to the Indian wrought iron in the construction of the tubular iron bridge across the Menai Strait. The famous iron pillar of 'Kutub' at Delhi is another instance testifying to the high skill of the men concerned. It is said to epitomise all the skill of the artisans required in the manipulation of wrought iron. "It is not many years since the production of such a pillar would have been an impossibility in the largest foundries of the world, and even now there are comparatively few where a similar mass of metal could be turned out", says the late Dr. V. Ball in 1879, and yet according to the most reliable information, this pillar must be at least 1500 years old. It has been suggested that this pillar must have been formed by gradually welding pieces together; if so, it has been done very skilfully, for not a single mark of such welding is to be seen. We have in this pillar, which, though it has always been exposed to the action of the atmospheric agencies, shows no sign of rust, the most complete testimony of the skill of the Indian iron-smelter of 1500 years ago.

The high skill of the labourers was not confined to the manufacture of wrought iron alone, but as in parts of Mysore and of Salem District attention was paid to the manufacture of 'wootz' (or Indian steel). The steel which was exported to European countries was subjected to critical examination so as to decide its quality. Mr. Stoddart, an eminent instrument-maker in England, stated that the 'wootz' in the condition in which it arrived from India was not fitted for fine cutlery owing to its inequality and impurity, but that by careful manipulation it was possible to improve it and bring it to a condition in which it was superior to English cast steel.

This production of high quality iron was not confined to any definite regions but has been scattered throughout India. The chief considerations for the establishment of an iron industry in those

days do not seem to have been as many as are necessary at the present day. They were fewer and far simpler and were confined to the availability within close proximity of iron ore, fuel (chiefly wood charcoal then) and flux. The combination of such a set of conditions was not hard to find in those days, and in the absence of foreign competitors there was a large internal market available for the home-made product. Thus the *agarias* or the native smelters seem to have played a leading role and their industry was a leading and thriving one. The very early development of sea-borne trade (which is traced to 800 or 900 B. C.) together with the prosperous condition of the industry gave rise to an export trade in iron goods.

Important and widespread as it seems to have been (judged from the wide distribution of slag heaps) at the present day, none of these, not even the more important of them figure as producers of the metal. The industry has been wholly crushed out of existence, owing to a variety of causes. The first of these is the fact that coal is not as widely distributed as iron ores. The Indian coalfields should be described, with reference to those for instance of Great Britain, as confined to a relatively small area, leaving large areas in the peninsular portion devoid of coal, not to mention the generally poor quality of the Indian coal. Hence coal could not be used in the reduction of the ore. In India, as in other countries smelting operations began first on the basis of wood charcoal and the use of wood charcoal in India was attended with results similar to those in Great Britain. The ruthless exploitation of the valuable forests led to their destruction, bringing about a fuel crisis. This destruction of forests went a long way in aggravating the situation.

The adoption in England and some other western countries of the use of coal as the fuel, the Industrial Revolution and the methods of factory production enabled them to produce iron more cheaply and place them also cheaply in foreign markets. In the 19th century the import of foreign made iron and steel goods into India gave the finishing touches to the strangling of the already tottering industry. The *agarias* found that it no longer paid them to prepare their products for sale and so discontinued their work. At the present day except in a few backward tracts, iron smelting by primitive methods is not being carried at all and the total annual production of all the primitive furnaces has been computed to be less than 1,000 tons.

It would be fruitful at this stage to study the conditions that go to the successful establishment of a modern iron and steel industry and see how far Indian conditions warrant such large scale enterprises as the Tata iron and steel works and similar works that have been established and that are projected.

A well-known metallurgist has said "Concentration of iron and steel industries is a natural consequence of the operation of a large number of factors of which location is but one, but not often the most important one. The complete transformation of the ore into finished iron and steel goods requires large quantities of fuel; the great bulk and low price of the ingredients as well as the end products and cheap transportation are of some consequence; the economy of mass production in single large units where all the stages of manufacture from the smelting to the making of the most highly finished products call for a large investment of capital, large organisation and a large population to supply an army of workmen." The bringing together of all these is in turn justified only when the supply of ore and fuel are large. The occurrence of any considerable number of these favourable conditions in any one place is rare, and hence the great importance of the 'Iron belt.'

The raw materials of such an iron and steel industry can be classified as follows:—

1. Iron ore
2. Fuel
3. Fluxes
4. Modifying metals
5. Refractory materials
6. Subsidiary materials

In the light of this classification let us proceed to analyse the position of India as regards these raw materials.

Iron ores.—The iron ore deposits of India have already been described and as a convenient means of recapitulation a tabular statement has been appended. (Vide Appendix I.)

COAL.

The reduction of iron ore (oxides etc.,) to metallic iron involves the use of some reducing agent and the chief reducing

agent in use at the present day is coal. It is only where there is an abundance of forests containing wood which is otherwise fit for no other purpose that wood charcoal is used. Excepting in Mysore all other furnaces in India use only coke and therefore our main consideration will be with coal.

India possesses vast resources of coal which is variously estimated, the estimates ranging from 54,000 M. tons to 75,000 M. tons. But large as it seems to be it is of no value to the iron industry. Coal is not used as such in the metallurgy of iron. Experimenters discovered in the earlier decades of the last century that by the destructive distillation of coal a new substance, namely, coke was derived which was able to withstand the conditions in a blast furnace better than coal. It was at the same time found that it was not all kinds of coal that yield coke on destructive distillation. The available quantity of coking coal would therefore be an important consideration in connection with iron and steel industries. Viewed from this point Indian resources are not very promising. Various estimates have been made of the available supply of coking coal in India all of which agree in India's poverty in that kind of coal. Coking coal in India is even less widely distributed than ordinary coal and this can be said to have decided the location of the black country of India in the vicinity of the "Iron belt" of Bihar and Orissa, for the small amount of the coking coal is distributed in two or three fields of the Damodar Basin, namely Giridih, Raniganj, Jharia and Bokara. The Assam coal, certain seams of which yield coke, is ruled out because of the high sulphur content.

The first three form the only sources of metallurgical coke-yielding coal in the whole of India. (Appendices III & IV.)

FLUXES.

The most generally used fluxes are limestone and dolomite; but in certain cases for special purposes apatite and fluorspar are also used.

Limestone is a mineral of wide geological and geographical distribution in India (they reach their maximum attainment in the rocks of the Cuddapah and Vindhyan systems) and hence there is an abundance of this mineral. But the main problem with the limestone is the supply of a cheap and uniform quality limestone, with a high percentage of calcium carbonate and comparatively free from silica and sulphur. Limestone of such a quality, usable

in the metallurgy of iron is not very widely distributed. The most important of the good quality limestones are : — (Appendix V.)

1. Katni limestone (lower Vindhyan)
2. Maihar limestone (lower Vindhyan)
3. Bisra limestone (Cuddapah)
4. Sylhet limestone (Kirthar)
5. Chela limestone (Khasi hills)
6. Wardha valley limestone
7. Dalli limestone.

Apatite.—This mineral is found in the Dalbhum district and the occurrence is sufficient for the iron and steel industry at the present rate of consumption.

Fluorspar.—This mineral occurs in sufficient abundance in the Kishengarh state of Rajputana.

MODIFYING MINERALS.

In addition to the three prime raw materials—the ore, the fuel and the flux—in the complete transformation of the ore into finished iron and steel goods, a variety of other materials which may be classed as modifying materials, refractory materials and subsidiary materials come to play a part. Let us take the modifying materials.

Modern age is an age of special steels where other metals play an important part either in modifying the physical characters or as purifiers and imparting certain special properties; and the following are the chief among them: —

1. Metals which are *modifying agents;* Chromium, Cobalt, Molybdenum, Nickel, Tungsten.

2. Metals which *induce changes in the physical condition and act as purifiers.* Manganese, Uranium, Vanadium, Silica.

3. Metals which act as *purifiers.* Aluminium and Titanium.

Distribution of the ores of the modifying materials: —

Chromite, the chief ore of chromium, is found in the Zhob and Pishen valleys of Baluchistan, the Kadukola district of the Mysore state and near Chaibasa in the Singbhum district.

Cobalt and Nickel have no ores in India.

Molybdenite and wulfenite, the chief ores of molybdenum, are found in Burma but is not in an economically profitable condition for exploitation.

Tungsten.—Wolfram is the chief ore and is found to occur in Kalimati in the Singhbhum district and Agagaon in the Central Provinces. But the most important occurrence in the Indian Empire is in the Tavoy district of Burma.

Manganese.—The full value of manganese in the iron and steel industry can be very well gathered when we state that according to a well-known metallurgist "steel cannot be steel if it did not contain 7% of manganese". It is estimated that over 90% of the entire world production of manganese is used in the steel work ; and in the light of this statement it is a deplorable fact to see the entire Indian production of manganese being exported. There are large resources of manganese in the Singhbhum district and the Gangpur state in Bihar and Orissa, in the Central Provinces, in the Bellary and Vizagapatam districts of Madras and in the Mysore state. The map shows the several regions.

Uranium is reported from the Gaya mica mines. The chief uranium minerals are Uranium ochre, Torbernite, Columbite, Zircon, Tripilite, etc.

Silica and fireclays.—Quartz and quartzite are the chief raw materials for the manufacture of ferrosilica. These are of wide distribution in India and especially good quality clays are found around the western base of the Rajmahal hills, as underliers of coal measures and in a number of localities in the Central Provinces and Bengal.

Aluminium.—At present this metal is imported from abroad. Bauxite which is the chief ore of the metal is of fairly wide occurrence in India, widely distributed in the laterite cap of the peninsula, but the laterites richest in bauxite are those of the Central Provinces, (especially of Katni and Jabalpur) and of some hill tops in Balaghat district (which contain more than 50% alumina); others are Sarguja, Mahabaleshwar, Bhopal, and the Palni hills and some parts of Madras. As at present mined they are not valuable. There is no possibility of exporting alumina after refining and concentration, nor is it possbile to manufacture the metal in India, as in both

the processes a cheap supply of electric power is absolutely essential.

REFRACTORIES.

These are fire-resisting substances both natural and artificial which have been found suitable for the construction of furnaces, kilns, stoves, etc. There are upwards of a dozen different kinds of furnaces in use in the modern iron and steel industry, (coke oven, hot stoves, etc.,). It is not unusual for more than one kind of refractory material to be employed in the different parts of the same furnace. These linings do not last indefinitely but require periodical renewal. The better the material, other conditions being the same, the longer is the life of the furnace, before repairs become necessary. The life of the lining depends upon the uses for which the furnaces are to be put. Blast furnaces used in the basic process of manufacture of steel require more frequent renewal of their furnace-lining than acid open hearth furnaces; and the furnaces preparing ferro-manganese requires still more frequent renewals than the basic open hearth furnaces. The linings of a blast furnace, if the most suitable materials are placed in their correct positions, may last for several years on continuous workings, while with faulty materials more frequent repairs become necessary.

The chief materials in common use are:—

1. *Bauxite,* whose raw materials are the bauxitic laterites which are of wide distribution in India.

2. *Chromite.*—Already dealt with.

3. *Dolomite.*—Much of the Indian marbles are crystalline dolomites (Rajputana, Aravalli), Mekrana, (Jodhpur), Kharwa (Ajmer), Maundla (Jaipur), Dadikar (Alwar), Narbudda gorge (Jabalpur) and Motipura.

4. *Fire-clays.*—Widely distributed; kaolin in the vicinity of Rajmahal hills; but there seems to be no attempt at manufacture of firebricks on a large scale for blast furnace purposes.

5. *Graphite.*—This is found distributed in parts of Travancore state, Tinnevelly district, Kalahandi, Patna state, Ajmere-Merwara and other places in India, but their utilisation should

await the introduction of the electrical osmosis process for the purification of impure graphite.

6. *Magnesite.*—Occurs in the Chalk hills of Salem, Kadukola in Mysore, in Rajputana and in Baluchistan. Most of the Indian production is exported.

7. *Silica.*—Large deposits of quartz reefs and pure white quartz are found in various parts of India. The Kharagpur hills represent one such instance in the vicinity of the iron belt. Essential qualities of quatzite or quartz for use in the iron and steel industries are they should contain 96% of SiO_2, 2% Fe_2O_3, 0.5% of alkalies.

8. *Zirconia.*—Zircon and Badeleyite are the chief ores. The chief quality of zirconia which make it fit for use in the iron and steel industry is its small co-efficient of linear expansion (it can be plunged into water at 1000°C.). Zircon is an important constituent of the monazite sands of Travancore. It is estimated that the monazite contains about 10% of zircon. Thus zircon would become a cheap by-product of the monazite industry.

9. *Sillimanite.*—This satisfies the conditions required of an ideal refractory almost completely. Its melting point is above 1830°C, and it does not soften below this temperature, having very low co-efficient of linear expansion; it is a chemical of great stability, and being neutral in composition is practically immune to the attacks of acid or basic substances at all temperatures below its melting point. Massive sillimanite is one of the strongest and toughest minerals known. In the form of fibrolite it occurs in large quantities in the Khasi hills of Assam and this is one of the largest occurrences of the mineral known in the world.

10. *Kyanite.*—A mineral of the same composition as sillimanite and occurring in the Manbhum and other districts of Bihar and Orissa can be substituted for sillimanite, because if exposed to a temperature of 1320°C. to 1380°C. it paramorphoses into sillimanite which change is attended with an increase in volume counteracting the shrinking of the clay.

The rapid survey of the distribution of the raw materials of an iron and steel industry, where all the processes of manufacture connected with the conversion of the raw materials into finished

iron and steel goods are undertaken, reveals to us a concentration of such raw materials in and around the 'iron belt'. The 'iron belt' has got the best possible situation in the whole of India for the cheap assemblage of the raw materials and the distribution of the finished products. The prime raw materials—iron ore, coal and flux are all found within the region itself while the other materials—modifying, refractory and subsidiary—are either found in the vicinity of the region or can be easily imported. Quartz, apatite, limestone and kyanite are found within the region. The belt is conveniently situated with reference to the port of Calcutta for the importation of magnesite from Salem and Kadukola, Chromite from Mysore, zircon from Bawdwin in Burma and cassiterite from the Malay peninsula. The early development of the coal-fields of Bengal with the consequent earlier advent of transport facilities, the convenient situation with reference to the raw materials, the proximity to a first-rate harbour like Calcutta and to the densely peopled region of Bengal capable of supplying an army of workmen, all these have contributed to the localisation of the industry in the 'iron belt'.

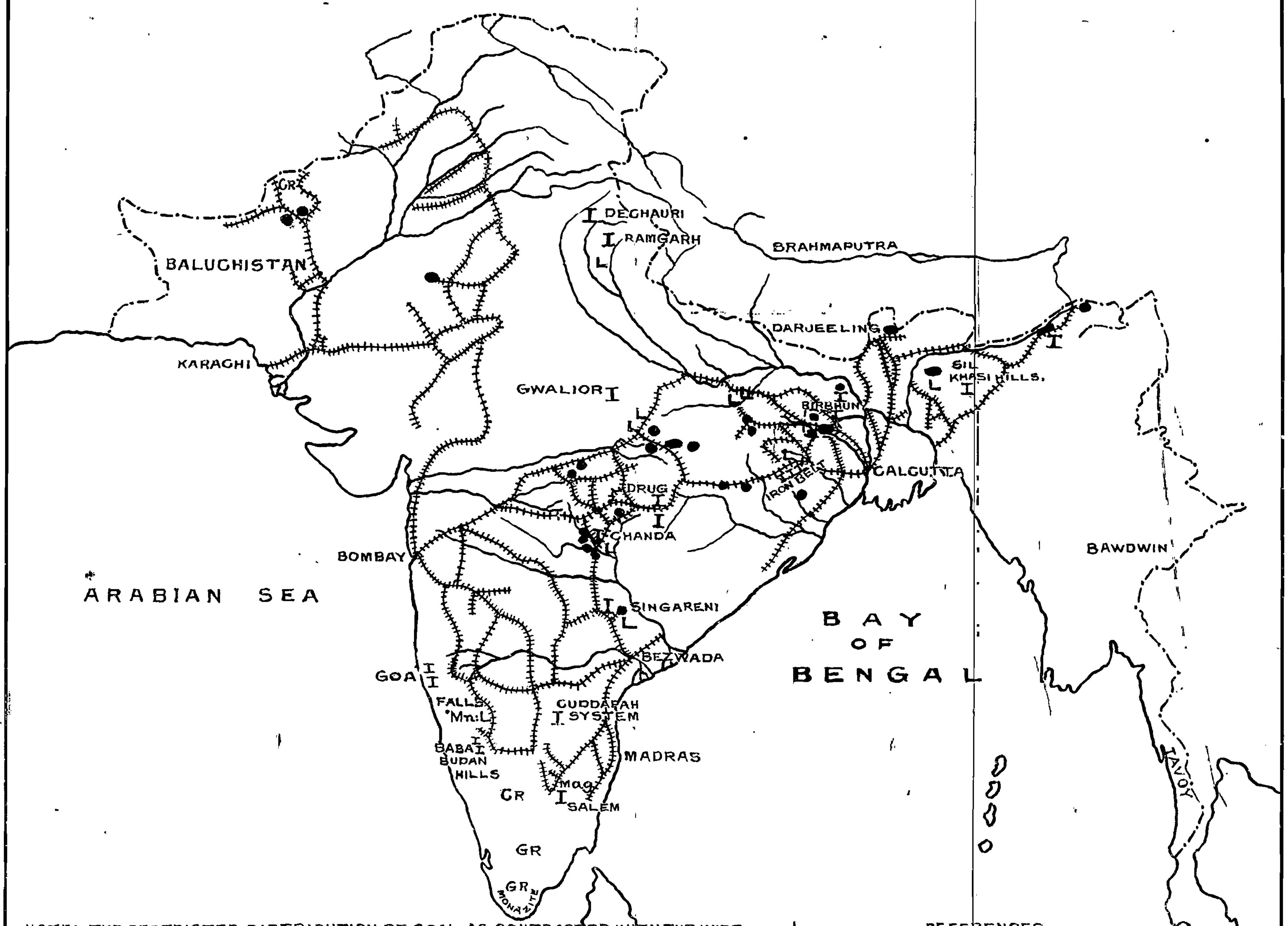
Among other regions Mysore has had the proud privilege of starting an iron industry based on the hæmatite deposits of the Bababudan hills, the limestone of the Shimoga district and wood charcoal prepared from the woods of the forests. The industry had the benefit of the valuable by-products of the wood distillation which served as props to the main industry. But with the universal slump in world trade the Mysore Iron Works find it very difficult to dispose of their by-products and seem to be (from what their representative had laid before the members of the Steel Enquiry Committee) much more in need of the much discussed protection than even the sister firms in Bengal. If sufficient protection is granted so that the industry can tide over the critical world slump, the government would have done something substantial towards ensuring the success of such an important industry. The proposed harnessing of the Gersoppa falls would have far-reaching effects on the industry. Already the industry is the largest of its kind in the British Empire, and it is famous for the quality of the pig iron it produces. The hydro-electric development and the adoption of electric smelting would make it possible for Mysore to rank on a level with the Swedish iron and steel industries as regards the quality of the metal produced. Finally the acquisition of a port for the state on the west coast would enable it to compete with Sweden as a producer of excellent steel.

All the other important occurrences of iron ore in India are not similarly situated with regard to other raw materials. Though they have been the basis of iron industries in the past, at the present day conditions are so changed that they are not so well situated at all for the establishment of a modern iron and steel industry. The fuel problem has accounted for the Kumaon ores, the Salem ores, the Gwalior ores and the Goa ores not being worked, while the poor and variable quality of the Assam ore is a drawback for its utilisation. The Drug district ores are held as a reserve, while the Chanda district ores do not have the same advantages as the ores of the iron belt. It is a curious thing to note that all the modern iron centres of India are based on iron ore occurrences discovered recently.

Of all the several occurrences, the Goa ore may be said to have a chance of development by virtue of its situation close to a harbour. An iron industry similar to the one at Bilbao in Spain and Cleveland in America can be built up here. The Salem ores, at least certain portions of them, have been pronounced to be unfit for use in the modern type of blast furnaces, so that there is no immediate hope of its being utilised on modern lines. They should await development till such time as a process is invented whereby they also could be used. What Gilchrist Thomas did for the Lorraine ores remains to be done for the Salem ore. The interior location of ore is a great drawback. If they have a situation similar to the Goa occurrence they would have been developed long before. Just as in Lake Superior region the ores can be smelted at a convenient centre by means of coal brought from Bengal, the empty steamers taking the ore to the industrial regions of Bihar and Orissa by way of ballast. But the interior location of the Salem ores on the other hand operates against such a development. The cost of transport of ore from Salem to Madras the nearest port would kill any attempt at exploitation of the ore. The same thing applies also to the problem of importing coal from the coal fields of Bengal. Anyway at some future date the ores are sure to be exploited, for with the decreasing importance of the now important ores attention would be turned upon these, and measures would be taken to utilise them. Such a thing will not happen in the near future; for as has been pointed out already, at the present rate of consumption the ores in the iron belt are estimated to last for about 100 years; and then there are the Birbhum lateritic ores and the Drug District hæmatite which are nearer to the industrial regions of the iron belt than that of Salem. Till then South India cannot

FIG 31

DISTRIBUTION OF COAL, IRON & LIMESTONE IN INDIA.



NOTE:- THE RESTRICTED DISTRIBUTION OF COAL AS CONTRASTED WITH THE WIDE OCCURRENCE OF IRON. ONLY THE IMPARTANT IRON-ORE OCCURRENCE ARE MARKED. IRON-ORE OF VARIOUS GRADES AND EXTENT ARE DISTRIBUTED THROUGHOUT INDIA EXCEPTING PERHAPS IN THE RECENT ALLUVIUM. AS IN THE CASE OF IROR-ORES ONLY THE IMPARTANT LIME STONE OCCURRENCES ARE MARKED.

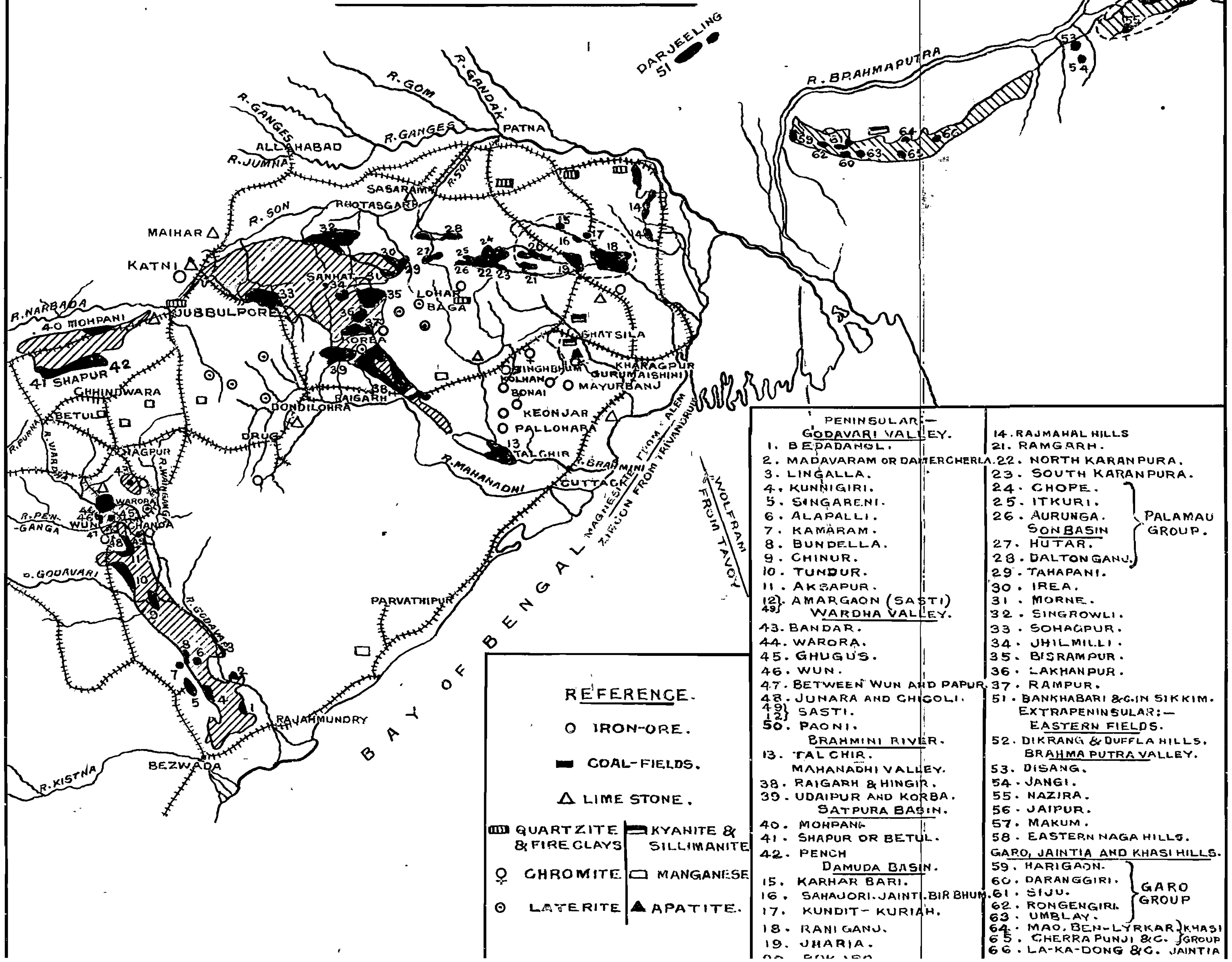
REFERENCES.

I - IRON-ORE
L - LIMESTONE
● - COAL-FIELDS

RIVERS
RAILWAYS
BOUNDARIES

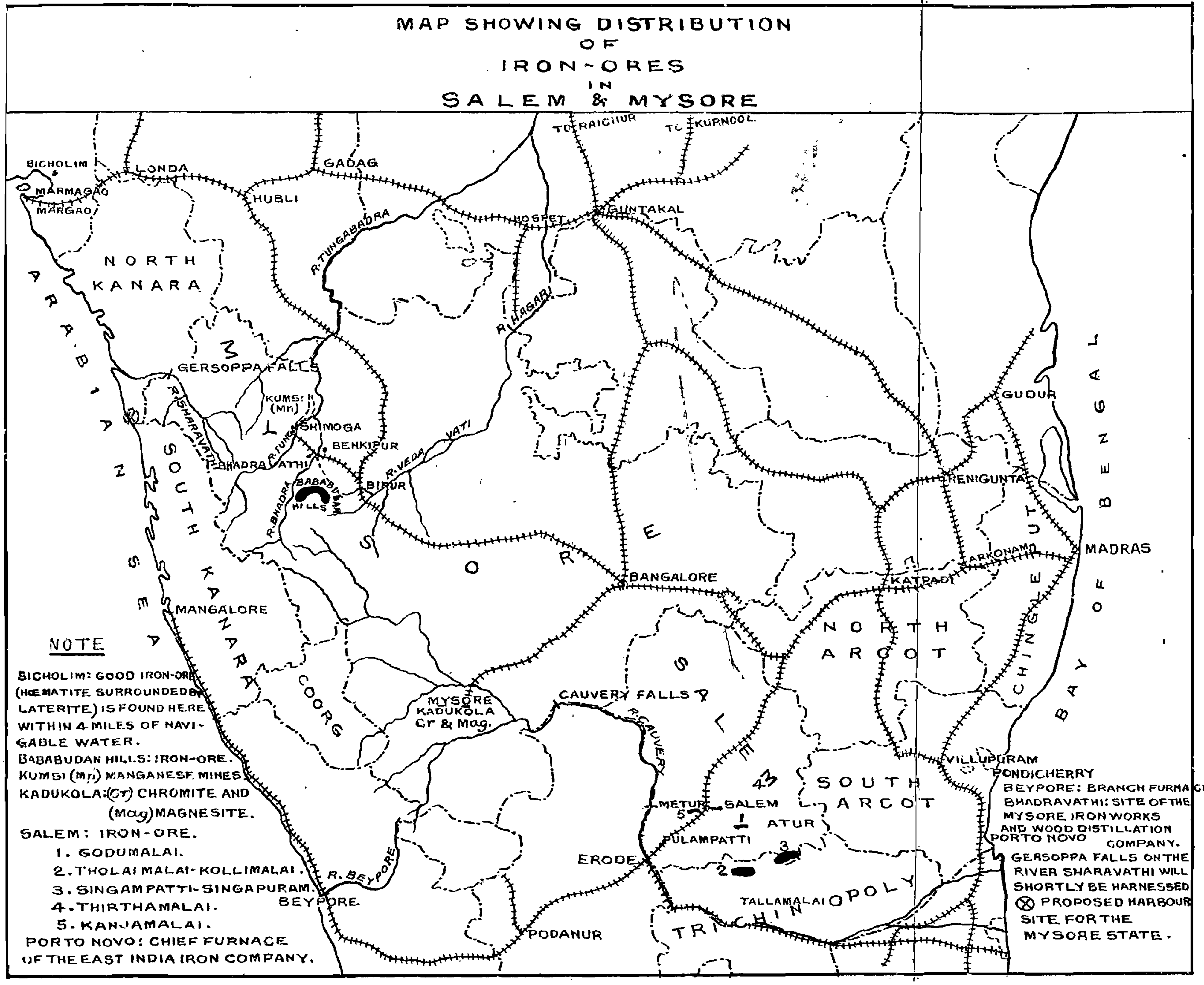
MN. MANGANESE
SIL. SILLIMANATE
Mag. MAGNESITE
CR. CHROMIUM
GR. GRAPHITE

FIG 32



RAW MATERIALS OF THE INDIAN IRON AND STEEL INDUSTRY.

FIG 33


MAP SHOWING DISTRIBUTION
OF
IRON-ORES
IN
SALEM & MYSORE
TO RAICHUR
TO KURNOOL
BICHOLIM
LONDA
GADAG
MARMAGAO
MARGAO
HUBLI
HOSPET
GUNTAKAL
R. TUNGABADRA
NORTH
KANARA
R. HAGARI
ARABIAN SEA
MYSORE
GERSOPPA FALLS
KUMSI (Mn)
R. SHARAVATHI
SHIMOGA
BENKIPUR
R. TUNGA
BHADRAVATHI
R. VEDAVATI
BIRUR
BABABUDAN HILLS
R. BHADRA
SOUTH KANARA
RENIGUNTA
GUDUR
BAY OF BENGAL
ARKONAM
MADRAS
BANGALORE
KATPADI
MANGALORE
NORTH
ARCOT
CHINGLEPUT
COORG
MYSORE
KADUKOLA
Cr & Mag.
CAUVERY FALLS
R. CAUVERY
SALEM
VILLUPURAM
PONDICHERRY
SOUTH
ARCOT
METUR
ATUR
PULAMPATTI
ERODE
R. BEYPORE
BEYPORE
TALLAMALAI
TRICHINOPOLY
PODANUR
NOTE
SICHOLIM: GOOD IRON-ORE (HŒMATITE SURROUNDED BY LATERITE) IS FOUND HERE WITHIN 4 MILES OF NAVIGABLE WATER.
BABABUDAN HILLS: IRON-ORE.
KUMSI (Mn) MANGANESE MINES.
KADUKOLA: (Cr) CHROMITE AND (Mag) MAGNESITE.
SALEM: IRON-ORE.
1. GODUMALAI.
2. THOLAI MALAI-KOLLIMALAI.
3. SINGAMPATTI-SINGAPURAM.
4. THIRTHAMALAI.
5. KANJAMALAI.
PORTO NOVO: CHIEF FURNACE OF THE EAST INDIA IRON COMPANY.
BEYPORE: BRANCH FURNACE
BHADRAVATHI: SITE OF THE MYSORE IRON WORKS AND WOOD DISTILLATION COMPANY.
PORTO NOVO
GERSOPPA FALLS ON THE RIVER SHARAVATHI WILL SHORTLY BE HARNESSED
⊗ PROPOSED HARBOUR SITE FOR THE MYSORE STATE.

boast of an iron industry excepting perhaps that of Mysore. Even if an industry were to be developed in these places it is doubtful if they can draw away the importance of the iron belt. In addition to the favourable situation for the assemblage of the varied set of raw materials, there will be the geographic momentum to carry that on.

CONCLUSION

That India has large resources of iron, enough to support a large scale iron industry would have been brought out in the preceding pages. There is the tradition behind it and the only thing wanting till recently in India was impetus, and the adoption of western methods of production. The failure of the many early attempts at the introduction of modern methods should be taken as a note of caution in the deciding of sites for future iron works. The enormous resources of iron cannot all be utilised except at a few places, till some such time when a process is invented which can help in the utilisation of the ores without the use of coke or other fuel. India is also rich in other raw materials and subsidiary materials for an up-to-date iron and steel industry and other associated industries and with a view to strengthen the foundation of these industries measures are to be adopted for the conservation of raw materials like chromite, manganese ore and magnesite, which are at present being exported on a large scale to other countries.

Some of the subsidiary materials like zinc and accessory materials like Tungsten are found occurring in the province of Burma. India's present political relations with Burma is an advantage for her in the matter of supply of these materials, and as long as this relation continues India will continue to enjoy this privilege. The present attempts at separating Burma may snatch away this advantage, which the Indian Iron and Steel Industry is now enjoying, as some people think will be the case with regard to Burma's oil resources. Well-wishers of India's industrial prosperity should therefore take the matter in hand and fight for the retention of the present political relations, at least with this selfish motive.

Lastly, there is ample scope for the development of a ship-building industry especially in the vicinity of Calcutta.

Provided these improvements and undertakings are adopted, India will soon be in the forefront in the world of Iron ad Steel Industries.

APPENDIX I.

(Raw materials: Iron ore.)

Type.	Deposits.	Reserves.	Composition			Remarks.
			Fe. %	P%	S%	
Magnetite	Godumala Kanjamalai, Salem Dt.	Estimated in thousands of millions of tons: No precise figures.	55	0.3 to 0.62	0.028	Said to be unsuitable for use in blast furnaces. All coke must be imported from Bengal fields.
Laterite	Mallarpur Rajmahal hill	Large: unknown	43	1.5 P_2O_5	?	Centre of the old iron industry of Birbhum.
	Kanhwara hills	49 m. tons	53	0.146	0.02	Suitable for blast furnaces: lack of fuel.
Clay ironstones	Raniganj coalfield	At least 400 m. tons.	38 to 46	0.09 to 0.41	Trace	2.5 manganese oxide. 2% (up to) Lime & Magnesia. 5 to 9% Alumina. 10 to 13% Silica. 10 to 12% Combined water; used till 1913 in the Barakar Iron Works at Kulti.

Haematite	Mayurbhanj Bonai & Keonjar Bonai Singhbhum Keonjar	16 m. tons 280 „ 656 „ 1074 „ 806 „ —— 2832 „	60 to 68	0.08	Trace to 0.6	Average Kolhanore. 64% Fe ; 0.05% of MnO_2. 2.1% SiO_2 ; 0.05% P ; 0.02% S ; 0.5% CaO ; 0.18% MgO and 1.25% Al_2O_3.
„	Singhbhum & Orissa	2832	60 to 68	0.08	Trace to 0.6	These ores lie within 150 miles of the coalfields of Bengal with coking coal capable of yielding metallurgical coke.
„	Lohara chand C. P.	100 m. tons at least.	61 to 67	0.005	0.12	Pilpagaon deposit not included. Local limestone good. Wardha valley does not coke. Operations in 1875 unsuccessful.
„	Rajhara Dondi Lohara Drug, C. P.	10 m. tons estimated.	66	0.058	0.108	Limestone at Dalli. Coke must be imported ; held by the Tata Iron and Steel Company.
„	Bababudam hills Mysore State	25 to 60 m. tons	42 to 64.5	0.044 to 0.105	Trace	Iron works were erected in 1922. Using charcoal for the production of pig iron.
„	Ramgarh and Dechani Kumaon	Not known	43 to 60	Not known.	„	Ramgarh ore siliceous, Dechani ore aluminous ; attempts in 1857 and 1877 failed through lack of fuel. No local coal.

APPENDIX II.

World's Resources of Coal.

	Actual Resources. Class of Coal.			Probable Resources. Class of Coal.			
	A	B	C	A	B	C	
	Anthracite coal including some dry coal.	Bituminous coal.	Sub-bituminous coal, Brown coals, and Lignites.	Anthracite coal including some dry Coal.	Bituminous coal.	Sub-bituminous coal, Brown coals, and Lignites.	Total
BRITISH EMPIRE							
Great Britain & Ireland ..	11,344	130,155	..	13	48,021	..	189,533
Canada ..	675	29,161	384,968	1,483	254,500	563,482	1,234,269
Newfoundland ..	..	..	..	..	500	..	500
Australia ..	99	1,971	219	560	130,279	32,414	165,542
New Zealand ..	..	389	612	..	522	1,863	3,386
British North Borneo ..	..	5	..	..	70	..	75
India ..	..	221	225	..	76,178	2,377	79,001
Africa ..	2	343	74	11,660	44,690	..	56,769
OTHER COUNTRIES							
United States ..	..	..	..	19,684	1,955,521	1,863,452	3,838,657
Germany ..	..	94,865	9,313	..	315,110	4,068	423,356
Austria-Hungary ..	..	2,974	12,585	..	38,121	1,923	55,603
France ..	581	3,622	301	2,690	9,058	1,331	17,583
Belgium ..	..	..	..	..	11,000	..	11,000
Russia ..	..	57	12	37,599	20,792	1,646	60,106
Spain ..	1,050	4,776	394	585	1,590	373	8,768

APPENDIX III.

Supply of Coal

(In millions of tons.)

	All kinds of coking coal.	Good quality coking and non-coking coal.	Total coal of all kinds.
Giridih ..	40	45	60
Raniganj ..	180	875	22000
Jharia ..	1160	480	20500
Bokaro ..	485	360	1520
Ramgarh ..	..	..	3
Karanpura N. ..	..	360	8900
Karanpur S. ..	..	..	75
Aurunga ..	..	..	20
Hutar ..	Some	16	9
Daltonganj ..	..		9
Talcher ..	..	36	44
Rajmahal Group			210
Totals ..	1865	2172	53350
Makuni ..	90	..	90
Namchik ..	90	..	90
Darangin ..	..	..	76
Nazira ..	..	..	20
Totals for Assam ..	180	..	276
Satpura ..	Some	..	100
Korea Rena, etc. ..	..	..	200
Wardha Valley ..	..	..	400
Total for C. P. ..	..	..	700
Grand Total in m. tons ..	2045	2172	54326
Available quantity allowing for 1|3 less in extraction, etc. ..	1400	1400	36000

APPENDIX IV.

Coking Coal in India.

Quality.	Field and Seam.	Amt. in m. tons.	Remarks.
I. Highest grade metallurgical coke.	Giridih L. Karharbari	9 9	Specially low in P. and also suitable for making iron of Bessemer quality.
II. Good metallurgical coke.	Jharia 13, 14-A, 14, 15 and 17.	732	Good quality coal. Total estimated 1100 m. tons. Allowance of 32 1|3%. Best coke from coke stack.
Ditto	Giridih L. Karharbai	30	Excellent coke. Sometimes rather high in ash, particularly if made from coal stack.
Ditto	Raniganj Laikdih and Ramgarh	50	This coke has been utilised in the Kulti furnaces; all allowances made only 5 m. tons in each.
	Total	812	
III. Fair Metallurgical coke.	Jharia 10, 11, 12, 16 and 18.	800	Some of this coal is as good as class II. Total estimated 1200 m. tons. 33½% allowances. Best used by carefully mixing with 17 seam
Ditto	Raniganj Dishargarh Sanctoria Beguna	 48 36 25	all allowances made. Some of this is known to be of good quality class II coal.
Ditto	Bokaro Kargar	 365	But there is a little uncertainty about the ash in the remainder. All allowances made.
	Total	1274	
IV. Good coking coal but not of metallurgical quality.	Assam fields	600	Very high in sulphur content. If this impurity can be improved this can be placed in class I or class II.

APPENDIX V.

Resources of Limestones (the important occurrences).

	Resources.	Composition.					Remarks.
		$CaCo_3$	$MgCO_3$	Al_2O_3 Fe_2O_3	Silica and insolubles.	Other constituents.	
Katni, Jubbulpore, (Central Provinces) Lower Vindhyan.	Practically inexhaustible. Composition somewhat variable, but uniform locally.	94.65	2.98	..	1.79	0.58	Extensively worked. These limestones strike steadily eastward and are being worked in Bihar at Rhotas and near Sassaram.
Maihar (Rewah) Upper Vindhyan.	Practically inexhaustible, uniform locally, but the quality varies along the strike.	96.03	1.75	0.96	1.15	0.11	Largely used for lime.
Bisra (Gangpur State) Cuddappah.	Very large, but interbedded with bands of dolomitic material; composition variable.	95.15	1.57	1.04	1.87	0.34	
Sylhet (Assam) (Kirthar Series)	Practically unlimited. Used for all domestic purposes.	95.4	1.81	1.72	0.58	0.49	

APPENDIX V. (*Continued*).

	Resources.	Composition.					Remarks.
		Ca Co_3	Mg CO_2	Al_2O_3 Fe_2O_3	Silica and insolubles.	Other constituents.	
Chela (Khasi hills)	Very large (unknown).	98.6	0.55	0.3	0.55	..	
Panchet hill.	Large but limited.	45.05	11.53	0.28 (F_2O_3)	39.28 (Insoluble)	3.6 0.7	Ferrous carbonate, Phosphoric acid. upper bed.
	Do.	63.40	14.41	0.62 (Fe_2O_3)	19.28 (Insoluble)	4.15 0.12	Ferrous carbonate, Phosphoric acid. lower bed.
Hanspathar	Do.	83.43	0.78	..	16.18 (Insoluble)	0.68 0.02	Ferrous carbonate, Phosphoric acid.
Dalli Drug, C.P.	Very large.	83.5	2.0	0.9	13.6	..	
Kandara (Chanda Dt., C. P.)	Unknown.	94.5 to 96.8		3.0 to 1.2	2.0 to 2.5	Traces of Phos.	

APPENDIX VI.

Imports into India of Iron and Steel goods during the years 1924 to 1928.

		1924	1925	1926	1927	1928	Average.
Cutlery		5,72,36,344	5,56,79,585	5,58,83,246	5,67,52,492	5,85,55,191	5,68,41,392
Machinery, etc.		15,53,44,993	15,95,48,216	15,13,37,077	16,57,87,417	21,04,39,807	16,84,91,502
Railway Plant, Rolling Stock, etc.		8,39,15,058	7,53,44,065	7,14,94,159	8,44,57,576	4,21,41,648	6,74,70,501
Iron bars } Pig iron }	Rs.	32,46,182	28,96,335	23,12,530	25,16,634	20,75,394	26,09,415
	Tons	18,001	17,775	13,503	19,455	14,657	16,678
Iron and Steel *beams* Sheets, Pillars, Rivets, etc.	*Rs.*	*16,68,06,548*	*15,47,92,396*	*16,63,32,509*	*18,25,16,326*	*18,81,48,943*	*17,17,19,344*
	Tons	6,82,369	6,68,920	7,38,950	8,71,813	11,13,458	7,95,102
Steel Bars, Angles, Ingots Blooms, billets, etc.	Rs.	3,55,87,206	1,79,31,685	2,41,14,554	2,76,83,218	2,66,84,083	2,64,00,149
	Tons	2,56,549	1,47,788	2,28,455	2,60,389	2,42,954	2,27,227
	Rs.	50,21,36,331	46,62,92,282	47,14,74,075	51,97,13,663	50,80,45,066	49,35,32,283

APPENDIX VII.

Exports of Pig Iron from India.

To	1924.	1925.	1926.	1927.	1928.	Average.
United Kingdom ..	8,828	28,708	15,314	21,140	8,920	16,582
Germany ..	...	11,595	3,166	9,926	8,542	6,646
Japan ..	1,49,697	1,58,713	2,30,913	2,65,226	3,21,010	2,25,112
U. S. A. ..	97,791	1,77,180	49,760	67,685	57,897	90,058
Others ..	14,759	25,598	16,009	19,983	32,256	21,721
	2,71,055	4,01,794	3,15,162	3,83,960	4,28,625	3,60,119
Rs. ..	1,79,78,296	1,98,66,537	1,42,19,549	1,74,28,304	2,01,50,789	1,79,28,695
£ ..	12,93,402	14,93,724	10,61,160	13,00,619	15,03,790	13,30,539
	£ = Rs. 13.9	£ = Rs. 13.3	£ = Rs. 13.4	£ = Rs. 13.4	£ = Rs. 13.4	

A meeting of the Association was held on Saturday the 2nd December 1933, at the University Geography Department, Wesley College, Royapettah, when **Mr. V. Kalyanasundaram, B.A. (Hons.) Dip. in Geo.** read a paper on **"The Geographical Basis of the Indian Iron and Steel Industry". Mr. K. C. Ramakrishnan, M.A.**, University Lecturer in Economics, presided.

The Chairman in his introductory remarks said: "On the subject of to-day's lecture, I do not think it requires anything to be said, except that it is an extraordinarily important industry, which we should study. There is no other industry to which greater importance is attached in modern times than the iron and steel industry. It is said to be the key industry, at least one of the several key industries, of a country.

There was a little joke about it in the Joint Select Committee and some people were questioning on the subject of commercial discrimination—whether at least in respect of the key industries there should be some kind of discrimination against British citizens residing and doing business in India ; and not clearly understanding the point, Sir Samuel Hoare said that the key industries were those where munitions of war were prepared, and he could therefore class iron and steel industries as key industries. I do not think there would have been any dispute of that.

Munitions of war are not the only important things. They may be the most important in times of war. In emergencies they may be the mainstay of the country. But besides munitions of war, there are so many uses of iron and steel. The present age has really been called an Iron age, where machines are being used, machines made mostly of iron and steel, like the railways, steamships, etc., and iron and steel are being used more and more even in a backward country like India. From the point of view of the very great uses to which the products are used, nobody can question the importance of iron and steel industry.

Further they give rise to a number of other industries. If once you install iron and steel works, a number of complicated machines have to be set up. You have to utilise the various by-products. For instance in the process of distilling wood into charcoal, you get a number of by-products. You have to find a market for them. I wish to point out to you, in conclusion, that there are no other industries, so important and complicated in their nature in respect of the enormous uses to which they are ordinarily put and in res-

pect of the most essential uses, in times of war, and for which you require a very high class of equipment, a large amount of capital and organised enterprise, than the iron and steel industries. For the study of this subject nothing is more important than an essential knowledge of Geology." With these words the Chairman requested Mr. Kalyanasundaram to read the paper.

Mr. Kalyanasundaram then read the paper printed above.

In the course of a lively discussion which ensued after the paper was read Mr. B. M. Thirunarayanan said that some more prominence should have been given to the various factors that would lead to a localisation of the iron and steel industry. The greatest drawback to the proper development of the iron and steel industry in India is the want of adequate transport facilties. An important factor for the localisation of the iron and steel industry is enough supply of coal, fuel or charcoal. It is in the neighbourhood of forests and woods where sufficient supplies of fuel may be obtained and also in the neighbourhood of local supplies of iron ore that the industry could be localised. But with the development of modern transport facilities this aspect of the question changed. With the coming in of coal for smelting iron, iron industry has centred itself in and near places where coal fields were situated.

Further, there is the question of the technique of the industry. Originally when iron was smelted with coal, the largest quantity of raw material required for the industry was coal. It has been estimated in Great Britain towards the end of the 18th century that about 3 to 3½ tons of coal were required for the production of every ton of metallic iron. But with the modern improvements in the technique, the centre of gravity has shifted from the coal-fields to the areas where iron ores could be found; and this change was augmented by the developments in transport facilities. In the United States and Great Britain there is just now going on a shifting of the industry from the coal fields to the regions where iron ore could be had. Perhaps the location of the Tata Iron Works should be taken as a parallel instance in this case.

Then there is another thing which struck me in the course of the lecture, namely, the little attention paid to the decline of the iron and steel industry in India and the disappearance of the ancient technique. Perhaps the most important and most powerful need for a country was weapons made of iron and steel. One of the many reasons that probably led to the decline of the iron and steel

industry in our country was the disappearance of the manufacture of weapons of warfare due to the coming of the Pax Brittanica. Practically, I think, iron and steel industry grew from out of this military necessity. Before the coalfields were discovered, there were certain ordnance factories existing in Bengal, maintained by the East India Company working at iron and steel. So it was the stopping of the manufacture of weapons of warfare that acted as the main cause for the decline of the iron and steel industry.

In winding up the proceedings the Chairman, Mr. K. C. Ramakrishnan said:—"The entire material for the lecture has been taken from books describing the past and forecasting the future. That tremendous industry has been displayed is quite evident from the exhaustiveness of the paper. It would have been better if the author of the paper had devoted a large portion of it to tracing the present conditions and difficulties that lie in the way of the localisation of the iron and steel industry in India. It is of course an exhilarating thing to deal with the glorious past than to detail the inglorious present. But an understanding of the present difficulties is more essential to shape the future; and for that we must face our present difficulties, explore them in detail, find out the remedies and thus help to shape the future.

The real success or failure of an iron or steel industry depends to a large extent on how far we are able to market the by-products that would result from an iron and steel industry. It is the problem of by-products that is the puzzling question. These should have been dealt at more length in the lecture. Further, if the Government had manifested some more goodwill, an iron industry could have been established in and around Bengal. The author should have dealt at some more length the present circumstances of the industry and the effects of scientific discourses. It would have been better if persons who have not studied the science has had it explained to them the different processes in the manufacture of iron and steel goods in a simpler language and at some greater length. Still, I am sure that when the paper is finally printed in the Journal it would be considered a very able and useful thesis.

But let me revert to some details. It has been said in the course of discussion that electric smelting is a misnomer. But I would like to know how far coal and charcoal are reducing agents and how far they are heating agents. If they could be used for heating, then electricity could also be used. To that extent electric heating, if not electric smelting, would be a proper term. In the Thalamalai, Kan-

chimalai and other hills near Salem, there are forests in abundance, though not like the thick forests of Malnad and charcoal could be had in plenty from those forests; and so it would not be a difficult thing to have a well-developed iron industry near Salem. In this connection, I remember a contribution to the Geological Journal of Mysore saying that in Salem there is no prospect of improvement of the Kanchimalai iron ores. Some millions of tons of iron could be obtained from the Kanchimalai,—which is richer in iron ores than the iron mines of Northern India and richer than the regions of Lake Superior. But the ores could not be utilised for lack of coal. In that article it was stated that there was not adequate coal in Salem and that Salem could also not have enough supplies of charcoal because the forests near Salem could not be so regenerating as the forests of Malnad due to climatic conditions. In Malnad there were plentiful rains. But if hydro-electric power could be brought to the area, if the immense potentialities of the Mettur project could be well utilised, then I am sure that the iron mines of Salem could be developed to an enormous extent.

Take again the case of the Tata Iron and Steel industry. Nearly 27 crores of rupees had been sunk into it. It is not merely the question of obtaining the raw material necessary for the industry that makes or mars the success of that industry. Transport facilities should also be taken into consideration. One of the greatest difficulties with the Tata iron works at present is that their contract with the B. N. Railway has terminated; and pending a new term of contract, the Government have requested the Bengal Nagpur Railway to keep up to the terms of the old contract. The Tata works had to get their coal from other places as distant as 180 miles. Freight charges would be heavily against them. That is why the iron and steel industry should have transport facilities. Many of the iron companies in the United States had their own steamships. They had a smelting industry on both sides of a river and with their own steamships, they had no waste of traffic either way. They could carry their coal to iron and iron to coal and the finished products overseas. The different interests of the industry are harmoniously organised as a single unit there and that made for large profit. Further they had big international trusts, cartels and combines to market their finished product. What India requires to develop her iron and steel industry is transport and marketing facilities.

In concluding my remarks, I would like to point to the depression in the iron and steel industry of Mysore. Mysore-

has always been in the grip of depression. True, that Mysore is a region with far greater rainfall than Salem and as such her forests could regenerate more quickly than the forests at Salem. But the greatest difficulty of the Mysore iron works is to market their by-products. Even in America, the iron works attempted charcoal as a medium of smelting. But they soon found that it was difficult to market the by-products that resulted from the manufacture of charcoal. That difficulty should be much more in a country like ours especially in Mysore where those by-products could not find a ready market. Actually large quantities of tar were thrown into the river in Mysore since they could not find a market for that. If they could find a market for their by-products, then the iron and steel industry of Mysore could thrive well. It started in depression, has been in depression throughout and the depression is getting keener day by day there. Before sitting down I wish to point out that the reader of the paper has put in a lot of industry and with some rearrangement and a little omission the paper would be a very useful one for the Journal.

With a vote of thanks to the Chairman and the lecturer, the meeting came to a close.

"Our Mysore Excursion"

BY

MR. N. SUBRAHMANYAM

Under the auspices of the Madras Geographical Association, **Prof. N. Subrahmanyam**, delivered an interesting lecture on "**Our Mysore Excursion**", in the University Geography Department, Wesley College, Royapettah, on Saturday the 11th November, 1933. **Mr. K. A. Nilakanta Sastriar**, University Professor in Indian History, presided.

In his opening remarks, the Chairman said, it was expected that Mr. N. S. Subba Rao, M. A., Bar-at-Law, Director of Public Instruction, Mysore would preside. It would have been ever so fortunate if Mr. Subba Rao had presided, but as the main business for which Mr. Subba Rao had to go over to Madras from Mysore was postponed, he could not be present and as such in the unavoidable absence of Mr. Subba Rao, he consented to preside. He then requested Mr. N. Subrahmanya Aiyar to deliver the lecture.

THE LECTURE*

Ladies and Gentlemen,—I and my party were very much anxious to broadcast our experiences in Mysore because our excursion was partly in the nature of an experiment. I have had a number of excursions with my students during the last quarter of a cenutry and in recent years after I became connected with Geography in the Teachers' College, the number of such excursions had increased. The peculiarity of this excursion lay in the fact, that it was for 10 days consecutively—the largest period on record, the previous longer excursions being for six or seven days only. A second way in which this excursion was experimental, was that three or four institutions joined in getting up the party, all the members being teachers and students of Geography at the same time. The institutions that participated in the excursion were the Lady Willingdon Training College, St. Christopher's Training College,

* The lecture has been very briefly summarised, as a full account of the excursion is given in the next article.—*Editor.*

the Teachers' College, Saidapet and the University Diploma Class in Geography. In a third way the excursion was experimental, and that was, it was a mixed party. We were like members of one family throughout the 10 days of the excursion.

On every one of the days, we had something very important to do; and doing that, everyone of us felt that even if it had been for that one thing the excursion was worth having. In the end we all felt that we derived a good deal of consumer's surplus, especially in view of the fact that the whole *per capita* expenditure, all told, was only Rs. 38 without any kind of railway concession.

On the first day we visited the Kolar Gold fields. At Oorgaum we were received by the Assistant Inspector of Mines. The most thrilling experience for our party there was that we went 4,800 feet underground in two minutes. The various processes by which gold was extracted—namely the powdering and mixing with water the amalgamation process and lastly the cyanide process—were all explained to us. The gold obtained by those processes was taken together once in a week or 10 days, melted in a crucible and gold bricks were made. As luck would have it, the melting was done on the very day we reached Kolar and we had the opportunity of witnessing the process.

The second day we went to Bangalore, where all the visits were arranged by the Secretary of the local branch of the Geographical Association. We first saw the Imperial Agricultural Dairy Farm. Then the Science Institute. In the evening we saw the Government Porcelain Works, Lal Bagh and the Bugle Tower. In the Imperial Dairy Farm we saw the process of making butter and cheese hygienically. At the Institute of Science, every one of the research workers was working from dawn to dusk, deeply interested in his work and unmindful even of his food. At the Government Porcelain Works we saw an instance of how in Mysore the industries and activities were co-ordinated. In an electrical State like Mysore, they want plenty of insulators; and instead of importing them, they manufacture them themselves. Out of the waste from the manufacture of insulators, chinaware, etc., were made. The only thing they imported was Plaster of Paris. From the Bugle Tower we had a birds'-eye-view of the entire city.

The third day we went to Sivasamudram waterfalls by bus. Right along the way, we had a number of worthy objects to see, which we would have missed if we had taken the railway route.

There are falls on either side of the island: one falling in the British territory and the other in the Mysore State. It was the Mysore falls, which were harnessed. (The power-house, the river, the pen-stoke and the inclined trolly lines were then projected through the Epidiascope.) One noteworthy feature was that the electricity so obtained from the falls was utilised even in the rural areas.

On the fourth day we travelled from Bangalore to Shimoga. It was interesting to notice the railway line running along a divide with head streams of different rivers on either side. We went to Malnad and found that it was on a lower level, and there we saw the valleys of the Tunga and the Badhra. In Malnad extensive areas of unirrigated paddy cultivation in terraces was the chief feature. At Sagar, sandal wood was the main item of export.

On the fifth day, our party went to Gersoppa to see the Jog Falls. The Mysore Government wanted to harness the falls, but the British Government feared that the beauty of the falls would be spoiled, if it was harnessed. (Views of the four different falls were shown on the screen.) Gersoppa was one of the most wonderful beauty spots and the thrill of it was so great that none of us had any mind to come away from it.

Seeing the Badhravathi Iron works formed the sixth day's programme. It was a very interesting place from many points of view. The co-ordination of industries and the utilisation of all by-products were the most important things to note. They get iron ore from the Bababudan hills, 20 miles off. Here iron was smelted with the aid of charcoal. In fact, it is one of the few places in Asia where iron was smelted with charcoal. For this purpose, all the wood obtained from the extensive forests in Mysore could be utilised. This was another example of co-ordinated activity. Again by the creosoting process, huge trunks of forest trees were made rust proof and white ant proof to be used as wiring posts instead of iron posts. Pipe foundry was another interesting thing to see at Badravathi.

The seventh, eighth and ninth days of our excursion, we spent in Mysore. We saw the Krishnaraja Sagar dam at Kannambadi where a beautiful terrace garden was laid out; and travelling seven miles along the Cauvery, we saw the monuments at Seringapatam. We went up the Chamundi Hills and saw the palace and temple there; we then saw the Exhibition, the Zoo and the Jaganmohana

palace. The last thing we saw was the palace illumination and Darbar. Through the kind help of one of the officials we were taken very near the Darbar and immediately after seeing the Darbar we rushed to the station to be back to Madras. We could not adequately express our feelings of gratitude for the unfailing courtesy and kindness we received at the hands of the Mysore officials who helped us in our tour.

Mr. K. A. Nilakanta Sastriar, in winding up the proceedings, said:—Ladies and Gentlemen,—It is a very interesting discourse to which we have been treated—frank, full and a very animated narration of experiences. I am sure that the members of the party feel extremely grateful to Mr. N. Subrahmania Aiyar, for the extreme care and foresight with which he provided for their personal comforts at every step of their, after all, not very adventurous journey. Mysore is a very civilised State with a well-established Government. It is a beautiful and progressive State, a State of which we have every reason to be proud, for there we can see how an energetic and benevolent administration has done everything to the best advantage of its inhabitants. The lecturer has so vividly described his and his colleagues' experiences in Mysore, that he has created in us all an unconquerable desire to take an excursion to Mysore. I thank you all for the great honour you have done me in asking me to preside on this occasion.

With a vote of thanks proposed by Mr. M. S. Sabesan, the meeting terminated.

An Account of the Excursion to Mysore

BY

MR. V. KALYANASUNDARAM, B.A. (HONS.), *Dip in Geo.*

I have made an attempt in the following pages to give a detailed account of the excursion to Mysore. In writing this I have made use of information collected not only during this tour but from what was collected during the geology excursion of 1929 and the knowledge which I had gained from books like the Mysore Gazetteers and reports of the Mysore Geological Survey. These sources I have drawn upon only as far as it is necessary to present the essay from the present viewpoint—the geographers'—and so have omitted much of geology which would be superfluous and which would not fit in with the theme properly.

I am much indebted to Mr. Subrahmanyam, for, without his untiring and never-failing efforts, the tour would not have materialised and I along with the others, would not have had the proud privilege of studying the regions from the purely geographical viewpoint. It was a revelation to us to know how much geography one can study from things which appear most commonplace to a casual observer; and it was all the more striking to me who had an opportunity of seeing the regions earlier before I had got the geographic outlook. My thanks are also due to Mr. G. K. Krishnamurthi of Bangalore, the Amildar of Sagar and Mr. Solomon Sekhar of Shimoga for the valuable tit-bits they gave us about their own regions.

Lastly, I am indebted to Mr. Subrahmanyam again for the synthetic view of Mysore—the Maidan and the Malnad—which we being young and inexperienced, were not able to get; and also for the comparison of the Maidan, the Malnad, the East coast and the West coast and the study of the reactions they produce upon the people.

The Salt Range of the Punjab has been called the field museum of Geology in India. In a way Mysore formed the field museum of Geography for the students of the L. T. and Diploma classes last September.

Before going to the details I would like to give a short description of the State of Mysore. The triangular plateau forming the Native State of Mysore is the southernmost portion of the Deccan plateau bounded on the east by the so-called Eastern Ghats and on the west by the Western Ghats, the two meeting at the Nilgiris. On the east the plateau descends rapidly to the level of the plains of the Carnatic, while on the west the Western Ghats give place to the narrow west coastal plain—the Konkan. The general elevation of the plateau is over 2,000 feet above the sea-level so that the plateau enjoys a milder climate than the Carnatic plain.

Structurally, the plateau does not show much variation. The gneisses of the Archaean system form the country rocks here; and

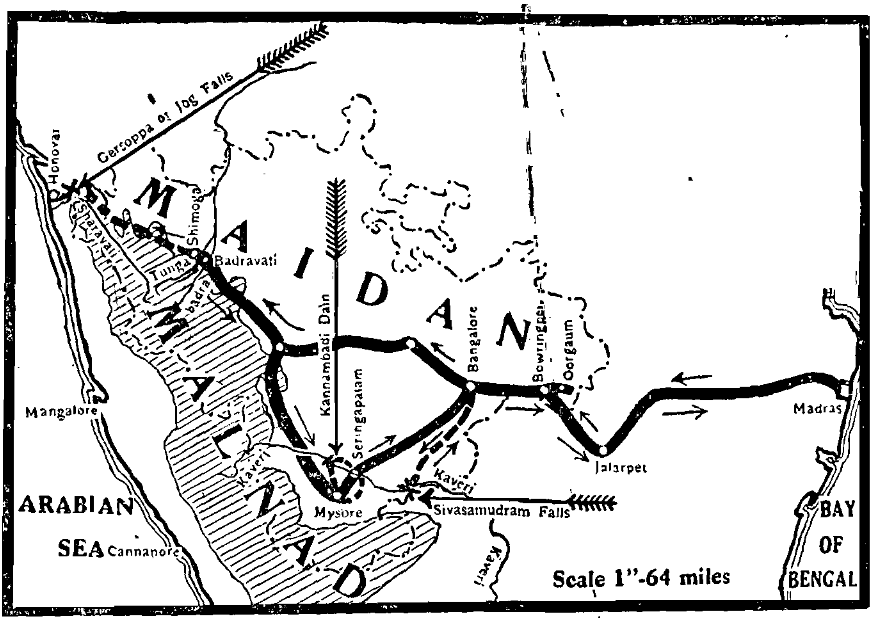


Fig. 34. Map showing route of Mysore Excursion.

intruded among them, as narrow lenticular bands, are the hornblende and the quartz Haematite schists of the Dharwar system—economically the most important next to the Gondwanas (being the chief mineral bearing rocks of India as a whole). The plateau is shut off from the rain-bearing winds of both the monsoons and is a region of *rain-shadow* receiving on an average about 40 inches of rainfall per year. This is reflected in its agricultural products, Ragi and Jowar forming the main crops here as also the staple cereal, yielding place to rice and cocoanuts along the banks of rivers and below the bunds of tanks. Other products are castor, tobacco, and

areca with coffee on the hill-slopes. Teak forests and sandal abound in the forested hills of the Western Ghats.

The people are all Kanarese-speaking; but the adaptability of Tamilians has led to their being found in places as far away as Bhadravathi and Shimoga, so that in such places Tamil too is understood.

Regionally the state can be divided into the eastern *maidan* and the western *malnad,* the one differing from the other in several respects; but in essentials in a general way they are related. More of this will be given in the last section of the essay and so we pass on to the detailing of the excursion.

Arriving at Bowringpet we changed into the Kolar Railway. It was a change in every sense of the word—from the fairly comfortable main line passenger train we boarded the 18th century type of carriage such as one is likely to find only in Salem branch railway, etc. The noise made by the engine was not proportional to the speed and there was a lot of jolting. This together with the anxiety to see Midas' food made us look forward with eagerness to the sight of Oorgaum station. The rock round about is the typical archaean gneiss or gneissic schist granitic in composition; but as we were nearing Oorgaum we discovered the lenticle of the hornblende schist replacing the gneiss. That very moment we entered the gold field, for the gold occurs only in this hornblende schist in quartz veins. The vegetation is of the scrub jungle type and as we approached still nearer to Oorgaum even the little patch of vegetation was getting thinner. We could see at the distance the cyanide hills—the landmarks of the gold fields.

KOLAR GOLD FIELDS

The gold here occurs as incrustation in quartz running in the form of a vein dipping down into the rocks at more or less steep angles. The associated minerals are galena blende and in the quartz veins are to be seen good crystals of tourmaline. On account of the dip of the vein the works are going deeper and deeper and at Oorgaum the boring has gone to 7,000 feet below surface level—a depth comparable to those of S. Africa.

The descent into the underground works are by means of vertical shafts worked by electricity up to about 4,800 feet and below this either by means of vertical or inclined shafts. There are

various levels where the workings were originally being carried but which have been traced down to lower levels. The scenery of the underground is a radiating intersecting system of tunnels, dark alley ways in the bowels of the earth. It is said that the total length of all the tunnels in the Kolar area is about 100 miles. The veins are worked by blast and when a certain stage is reached the blasting is stopped and the walls are supported by wood props. This removal of solid rock necessitates a readjustment of the forces, which readjustment manifests itself in the form of rock bursts. Less frequently there have been fires from the wood props. The situation was anxious, at least to me, when I just lost myself in reveries thinking about what would happen if the rock burst were to take place just then. For some others it was a trying ordeal.

The ore—the blasted rock—is conveyed to lift level by means of trolleys hauled by manual labour and then hauled up to the surface by the lift. From the shaft the trolleys are transported to the works along rails and drawn by rope ways.

PROCESSES OF THE EXTRACTION OF GOLD

The first stage in the extraction of gold consists in the breaking of the large boulders into smaller pieces either by means of manual labour or by means of machines. The broken rocks then travel round in a continuously moving belt on either side of which are a number of coolies standing. Their business is to remove the pieces of hornblende schists if any in them. This done the rock pieces are passed on to a mill where they are crushed to powder and made to mix with water and flow away. This is done as follows: The apparatus consists of a huge steel piston working in a cylinder of a similar metal, a contrivance resembling the pestle and mortar used by toothless old persons for powdering and mixing the ingredients of Pansupari. While the piston is working water is made to pass through the cylinder and this serves a double purpose, it serves to cool the machine and at the same time its main function is to form an intimate mixture with the powdered rock. It should not be understood to be a solution, it is merely a mechanical mixture in which the solid material remains in a fine state of suspension.

This mixture of water and the finely powdered ore is then allowed to pass over a metal trough covered with a blanket, the trough itself being inclined at a convenient angle. The rate of flow

of water and the angle of inclination of the trough are such that when the water passes over the blanket the heavier gold particles (gold being six times as heavy as quartz) are arrested and the lighter silica and the associated minerals (galena and blende unless intimately associated with gold) flow away.

The separation of the gold is not complete in this process. Some gold does pass away without being arrested and to recover it in part the solution (for want of better or more appropriate term I am using this, not in the strictly technical sense) is allowed to pass over a second set of trays or troughs containing mercury-coated plates. The gold present forms an amalgam with the mercury and the silica and other minerals pass down. In order to aid this process there are persons who manipulate the flow of water and work with their hands on the mercury plate to ensure the process of amalgamation.

It should be understood that in this stage too the separation of gold is not complete, the final process being completed in the cyanide vats stage. But at an intermediate stage by an ingenious contrivance of the inclined trough and flowing water the separation of iron is effected.

The third stage in the separation of gold is the cyanide vats stage. The rich slimy mud is put into large vats—huge concrete tanks resembling oil tanks but open at the top—containing a solution of Potassium Cyanide and is allowed to remain there for two to three weeks. During this interval the gold is acted upon by the cyanide solution, the resulting product being Potassium auricyanide, the silica remaining as a sediment. The solution is then pumped into smaller tanks where gold is precipitated by the use of zinc shavings. The sediment left in the cyanide vats go to augment the size of the cyanide hills.

The gold in the blankets is washed out by a powerful blast of water and mercury gold amalgam is distilled ; the mercury sublimes away which is then cooled and collected for future use.

The gold obtained in the three processes then goes to the final stage where it is molten and made into ingots. The gold from the three stages is put into refractory crucibles and heated by means of oil burners. The gold melts and forms an ingot, the silica in it crystallising as glass. We had the unique opportunity of seeing an ingot being taken out from the stove, weighed and marked. That

was the first of a series of incidents which showed that "luck was dogging our footsteps". The truth of the statement could be realised only by the people who know the circumstances of our excursion.

The cyanide sediments and the shaft heads form landmarks of the gold fields. The cyanide hills, flat-topped and without any vegetation on their sides, provided us a good example of the destructive action of water and examples of land forms known as bad lands.

The feelings of the members of the tour party were beyond all description due to the sight of two huge lumps of Midas' food worth thousands of pounds, the novel and thrilling experience of going down into the interior of the earth—4,800 feet in 2 minutes—the dark passages in the interior, the quartz vein carrying the gold, the thought of rock-bursts and our safe arrival at the surface and the excellent arrangements which our host had made at Oorgaum. That single item alone was worth the expense—members began to say.

That afternoon we bade good-bye to our host and the gold fields and arrived at Bangalore city to spend a most enjoyable time under the able guidance of our untiring and selfless host there Mr. G. K. Krishnamurthi. We were comfortably lodged, the male members in the Central College Hostel and the ladies in the Vani Vilas hostel.

The next morning, thanks to the foresight and the excellent arrangements made by Mr. G. K. Krishnamurthi, we started out at 8 a.m. to see the Imperial Dairy Farm. We saw the various breeds of bull and cattle and breeding bulls. The methods adopted for the proper preservation of fodder during the dry months, learnt about the food contents and the digestive contents of the various kinds of fodder and saw the process of cheese manufacture, butter manufacture, the cold storage room, etc. This finished, we made a long hop to the other end of the town where the Indian Institute of Science is situated. We were led round the institute by Mr. Varadachari of the Bio-Chemistry section and saw the various departments. Things of special interest to us were the telegraphic transmitter and receiver together with the jumbler and resetter, wireless transmitter and receiver, step-up transformers and generators, ice manufacturing machines, the Plant Nursery and Plant investigating section, the bio-chemistry section and the liquid air plant. In the afternoon Mr. Varadachari showed us round the acti-

vated sludge plant whereby refuse water is made usable and he compared it with the old fashioned process.

The next item in our programme was the Mysore Government Porcelain Factory. This is a direct outcome of the enterprise of the State. The harnessing of the water power at Sivasamudram and its distribution require a large number of insulators. The State has a good supply of the ingredients of porcelain. Thus, the impetus to the industry was given by the electric development of the State.

The three ingredients are quartz, felspar and kaolin all of which are available in the neighbourhood itself and within easy assemblage. In the initial stage the quartz and felspar are ground to powder, the powder is then intimately mixed with kaolin in the presence of water into a slimy paste. This paste is then allowed to remain in that condition for a period of not less than two months before it is taken for use.

The prepared clay is then pressed into moulds and the annular rings of the insulators made on it by mechanical means and after this process it is removed from the mould and passed to the stove. In the process of preparing the insulators there is a large amount of the clay that falls into bits and these have given rise to another industry, namely, the models and the cups and other related porcelain articles. The process of preparing cups is very simple. An intimate mixture of the clay in water—a colloidal solution is poured into moulds. The water in the solution soaks into the particles of the mould and thus a thin film of solid clay is formed on the inner sides of the mould. The solution is then poured off and the mould allowed to stand for some more time whereby the water in the thin film is all absorbed by the mould and the cup comes out by just shaking the mould. The handles are afterwards separately attached. Similarly for models also.

The prepared models are then baked either in a hot air stove or in an electrical stove. The hot air stove consists of a cylindrical chamber capped by a conical structure and heated at the bottom by means of coal. The walls of the stove are lined with refractory bricks and the door is also of a non-conducting material. The models are arranged inside the stove which is then fired, the changes taking place within being viewed from without as also the temperature. After a certain temperature the doors are opened and the

charge removed. The furnace alone costs Rs. 7,000, while the electric stove costs about Rs. 3,000. The only material that the factory gets from abroad is its supply of plaster of paris for making moulds. This is one of the many instances to show the development of natural resources in the Mysore State.

The next item in our list was the bugle rock. This is the highest eminence in the city of Bangalore; and standing on the platform one gets a view of the whole of Bangalore city—the interesting way in which the city has developed. Here the archaean gneiss outcrops as a single solitary hill which has been improvised into a sort of watch tower.

Lal Bagh, the last item in our programme at Bangalore, was gone through in a hurry. Unfortunately we could not do full justice to the most beautiful place in Bangalore. The tall towering silver oaks and pines arranged symmetrically around the statue of the late Maharaja of Mysore have left a lasting impression in our minds and it is not easy to forget the other beauty spots in the place.

Sivasamudram Falls formed the next item in our programme. The motor journey from Bangalore to Sivasamudram gave us a nice view of the country we were traversing. The change in altitude was perceptibly felt. We were feeling hotter as we wended our way slowly towards the falls. The vegetation was mostly of the scrub jungle type, but along valley axes and where easily irrigable lands are found the character of the vegetation changed. The ground was levelled and brought under the plough. Cocoanut and paddy fields mark the water region. Terrace cultivation of paddy was to be seen at places. But the predominant crop, I think, was Cumbu and Jowar.

Geologically the route lay through the same archaean country as we found in the Kolar area. The coarser type of granitic gneisses (without much of accessory minerals) disintegrates into a fine white clayey soil. One could see this clay formation at several places along the roadside where a stream had cut its way and at one place a basin-like area, which is probably the drainage area for the surrounding country, was completely covered with this and it was a striking contrast to see the bare white formation immediately after the green verdure of the fields lying close by but separated from it.

On our way we passed by the Malavalli tank and could see the Mallavalli hill in the far background, whose neighbourhood, our

professor told us, was the scene of a battle sometime during the Muhammadan rule of Mysore.

Nearing the Cauvery, a turn to the left carried the road over the supply channel and in another half a mile we were at the Falls. We could hear the Falls and see the foam rising above but could not get a clear view of the same. Everyone was eager to get the first view and all of us walked down a distance of a furlong and a half to get a close up of the Falls.

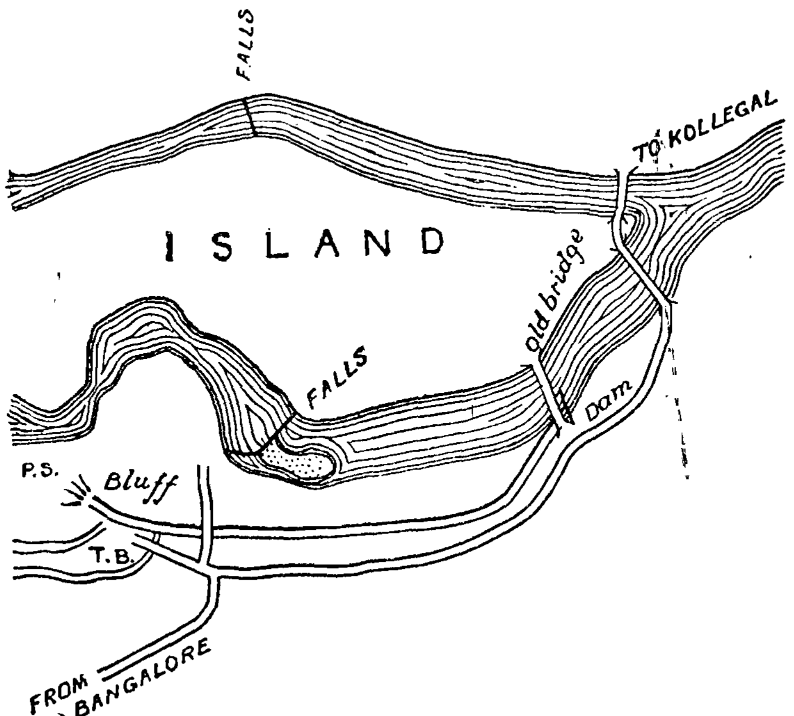


Fig. 36. Sivasamudram : the Island, the Bluff and the Falls.

The Cauvery river flowing over the gneissic rock which, as has already been seen, forms the bedrock in most of Mysore, divides itself into two branches at a point a mile or two above the Falls. One of the branches goes through the British territory, the other through Mysore State before joining its cousin below the Falls. Both the branches leap over the edge of a gneissic cliff 320′ high at the Falls of Sivasamudram, a name historic in the development of Mysore and a household name in almost all the villages of S. Mysore. That branch of the river which takes

the leap down the cliff in the Mysore territory is bifurcated into two by a lenticular mass of the gneiss and so falls in two branches. The river has cut a deep winding gorge which stands as a monumental specimen of the slow but sure and steady work of nature's moulding agents.

Fig. 37. The Falls, Penstokes and Power Station.

The island of Sivasamudram had been a place of historic importance—purely due to its location—but now it is nothing but a mass of ruins. The venue of importance has changed from the island to the Bluff—as the place is called where we have the modern colony and it is a clear evidence of the changing importance of things—characteristically geographic and marks geography as a dynamic science.

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The island of Sivasamudram had been a place of historic importance—purely due to its location—but now it is nothing but a mass of ruins. The venue of importance has changed from the island to the Bluff—as the place is called where we have the modern colony and it is a clear evidence of the changing importance of things—characteristically geographic and marks geography as a dynamic science.

THE HYDRO-ELECTRIC POWER STATION

The Kinetic energy of the falls which was going to waste till recently has been harnessed and the mad fury of the waters in coming down the height is made to do something more usfeul than merely throwing itself down madly. The genius that has been responsible for this is none but the late Sir K. Seshadri.

The main considerations in the successful development of hydro-electric energy are the regular supply of water through the year round and a certain 'head' as it is technically called. The popular notion that the generator would be placed just at the foot of the falls had been clean wiped out when we came to the actual works. The first of the above considerations is fulfilled by the construction of a small dam at the site of the old stone bridge across the river at a point a mile higher up the river, from where a portion of the water is conveyed by a supply channel. The bed of the channel in order to conform to the level of the surrounding country is lowered in a step-like fashion so that there may be no undercutting of the bed.

The water from this channel is stored in a large tank at the edge of the Bluff from where it is conveyed by means of huge pipes 5 to 6 feet in diameter called penstokes to the power station situated below at the foot of the Bluff and in a level with the river. The amount of water flowing through the penstokes is regulated by the load and the excess water which is not utilised flows down another channel to join the main river. The head of the water column is 420 feet.

The essential units of the power station are the water turbines and the generators. Dynamos which produce electricity electromagnetically require some motive force to rotate them and this is supplied by the turbines. The water coming down the penstokes gain force in their descent and this force is made to rotate the vanes of the turbines and the axis on which the vanes move is coupled to the axis of the generator. Each turbine has a penstoke attached to it.

The Sivasamudram power station has eight generators, two of 6,000 K. W., two of 3,000 K. W. and four of 1,500 K. W. and one more is under construction. The current produced by the generators is raised by connection through a step-up transformer to 78,000

volts—this is absolutely essential in view of the fact that the current is not consumed in the immediate neighbourhood but has to be transmitted over long distances and this means wastage due to the resistance offered by the metallic conductors and the atmosphere. There are four routes of transmission respectively to My-

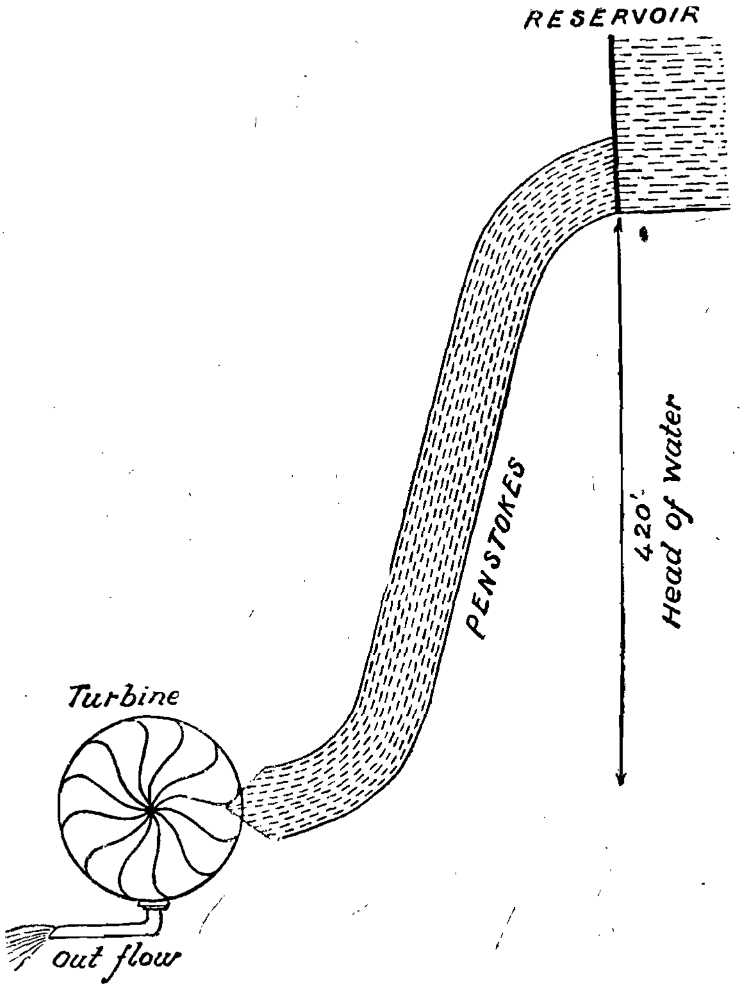

Fig. 38. Reservoir, Penstokes, and Turbine.

sore, Bangalore, Kolar and Mettur. Each route has a double line to serve in emergencies.

The power station is connected with the Bluff by an inclined trolley line and there is a similar trolley line but of lesser gradient to bring down the plant and machinery.

The cheapness of electricity has led to its being utilised for an innumerable number of purposes which a person in parts of Madras Presidency would never even have dreamt of. The Chennapatna silk factory and toy factories are worked by electricity and a number of places—mere unions—had electric lights. The electric lights, the artistic way of delimiting the towns and villages along the road with name boards and such things go a long way in enhancing the beauty of places which are already naturally well-endowed. We were told that electricity was used at places for pumping water for irrigation purposes. We were back at Bangalore that night and went to bed for a well-earned rest and to prepare ourselves for the long journey that was before us.

7 a.m. on 24th saw us off to Shimoga. The journey was by day and we utilised the interval in the best manner possible—by studying the landscape from the train. At first the route lay through the gneissic country and the whole maidan is studded with a number of hills and hillocks, the highest of which is the Sivagiri hill. It is a typically undulating area with the said hills and hillocks relieving the monotony of the rolling ups and downs; and the railway traverses the ups and other ridges by a number of cuttings. They would have been of importance from the geologist's viewpoint; but, for us they afforded an interesting study of rock-weathering. Passing from the gneissic the train enters the Dharwarian schist belt, a change which is strikingly felt. The Dharwars are one of the richest—economically—of the rock formations of India, it being associated with the ores of iron, manganese, gold, asbestos, chromite, etc. The iron ore mountain of the Bababudan—the steep south-eastern scarp of which could be seen as we travelled, is composed of the hornblende schist and the quartz haematite schist—formations typical of the Dharwars.

The railway line from Bangalore to Hubli traverses through an interesting country. It takes the water-parting between the Cauvery and the Penner till we reach Arsikere and then along the divide between the Hagari and the Cauvery. It was interesting to see actually the water divide between two river basins.

The natural vegetation of the divide is of the scrub jungle type, lantanas abounding—with palm as a variety; but the valleys are irrigable and hence cultivated. The valley axes present a verdure due to the paddy fields and cocoanut palms while on either side the paddy and cocoanuts give place to jowar, cumbu and the

palms which are finally replaced by the lantanas at the 'ups'. At Tumkur, the famous cocoanut marketing centre, we could see wagon loads of cocoanuts at the railway station.

In our progress westwards we were entering a region of increasing rainfall and the character of the vegetation consequently changed from scrub jungle to mixed scrub and woods and finally to forests. As we were nearing the hills of the Malnad, we could see the forested slopes from the train. The temperature, rainfall and soil conditions of these hill slopes are admirably suited for coffee and hence coffee is an important product of the region. Kadur—the headquarters of the district of the same name and on the railway line, is the market for the plantation coffee from the Malnad and is a very busy centre. The increasing rainfall gives rise to arecapalm and arecanuts form a large item in the export of Birur. The route from Birur to Shimoga lay through the same type of country, but more forested. There is a down gradient generally from Birur up to Shimoga and near Tarikere it is a continuous down gradient for over a mile and a half, a thing which very well explains the momentum gained by the goods train during the recent train smash.

After crossing the Bhadra and the Tunga, Shimoga was reached at 6-30 p.m. and we were comfortably lodged in the National Lodge. We were all in high spirits, eagerly looking forward for the sight which the morrow had in store for us; but it was not an unmixed joy, as we were having an anxious time of it owing to the indisposition of one of our party and were faced with the proposition as to how to arrange for the patient. But luck which had been in our favour was again in evidence. The patient got well enough next morning. This was not the only evidence of our luck. We were to learn that it had been raining in Gersoppa for some time but thanks to our luck, there had been no rain for three days past.

Shimoga.—The location of Shimoga served us well in studying the phenomenon of inversion of temperature. Its altitude is just about a thousand feet less than that of Bangalore and as one would naturally expect it is hotter during the day time. But its being surrounded by mountains on all sides accounts for the other phenomena—the cooler and misty nights which would at first sight appear inexplicable. The inversion is so pronounced at certain places that it is often 9 or 10 a.m. in the morning before the mist clears away.

VISIT TO GERSOPPA

On the 25th we were joined by Mr. Kuriyan, and we all left for Gersoppa which proved to be the most thrilling experience for all of us. The road lay through the maidan portion of the Mysore State till the foot of the Ghats and then crossed the Ghats in a picturesque and steep-sided ghat section, bursting into sight of the river almost before we could expect it. The road was an interesting study by itself clearly denoting the change in rock. For the first 25 miles the metal was the granite gneiss, the white road metal that people in Madura and parts of Salem district are acquainted with. This gives place to manganiferous road metal which manifests itself by its colour, resembling the older overbridge at Egmore just after it is covered with heavy crude oil. Still further west the manganiferous limonitic rock gives place to laterite of the Ghats proper—there is no surer indication than this to denote that we have reached the region of heavy rainfall. Laterite has entered into every phase of the life of the people. Their houses are built of this—on account of the ease with which it yields to chiselling; it is easily cut into blocks of required sizes in the quarry itself and placed one above the other with a little cement and the percolating water will do the rest; at other places the laterite mud is made use of in much the same way as cement or lime plaster is used in case of a brick wall, only here instead of a brick wall they have bamboo pillars and fences. All the houses are built of this material. If it happens to be a rich man's house, the laterite is cut into regular bricks and the roofs are covered with Mangalore tiles. It also serves as a ready road metal.

VEGETATION OF THE COUNTRY

For the first 20 or 30 miles the lantana thickets lined the road with a few trees further away. The fields were sown with jowars and a kind of grass for fodder purposes. As we progressed westwards we were entering a region of increasing rainfall. This has its influence on the vegetation. The lantana thickets give place to forests with bamboo thickets at certain places, the forests gradually becoming thicker. One could see tall trees towering above the slender shrubs with the wiry lianas turning round and climbing up their tall robust cousins and getting as much benefit of the sun as their powerful cousin. Further westwards the forests become very thick so that it is with difficulty that one could look through and the dominant note is played by teak trees both naturally and artificially grown. The sandal wood tree also is prominent.

But it is in crossing the Ghats proper that one could see the wonderful natural scenery associated with the Malnad. In the valleys and basins paddy and sugarcane are cultivated—an unirrigated crop grown in terraces—the lower slopes are covered with thick forests with gaily coloured orchids along the road cuttings, while the upper slopes and the highest portions are covered with grass. The forest-covered lower slopes and the grass-covered higher portions recall to one the typical Alpine scenery.

The region is one of very heavy rainfall receiving at certain places—we were told, an annual rainfall of about 200 inches on an average, for the whole of Malnad the rainfall would exceed 100 inches; and accustomed as we are to a maximum of 40 to 50 inches we cannot imagine what it would be like to have over 100 inches and that too crowded together in a few months. This is one of the main problems to be considered in the maintenance of roads. There is so much of soil erosion that the road to Gersoppa especially near the river resembled rather a rocky bed of a mountain stream in a dry country than a metalled road. In this connection one cannot help making this statement. The Falls themselves excepting the two minor Falls are situated in the British territory and the last 7 or 8 miles to the Falls is also in the British territory but the whole thing is maintained by the Mysore State. This speaks very highly of the attention paid by the State in the matter of accessibility to natural beauty spots and indirectly promoting a tourist industry. India has much to learn in these respects from western nations, especially Germany ; and it is gratifying to note that Mysore is in the foreground in this as in so many other things.

The Falls.—Of the many rivers that drain into the Arabian Sea from the Mysore State the Sharavathi is one of the most important and may prove to be a household word in the electrical world of the days to come. Rising near Ambuthirtha, it flows in a north-easterly direction for half its course and then takes a westerly course to the Arabian Sea. On reaching the frontier between the Mysore State and Bombay Presidency the river precipitates itself down the celebrated Falls of Gersoppa. These form unquestionably the grandest beauty spot in Mysore, rich as it is in splendid scenery. They eclipse every other fall in India and have few rivals in any part of the world. While excelled in height by the Cerosoli and Evanson cascades in the Alps and the Falls of Arve in Savoy, the Gersoppa Falls surpass them in the volume of water precipitated; and while much inferior to the Niagara in volume, it far excels these celebrated falls of the New World in height.

Cerosoli with a height of 2,400 feet, Evanson of 1,200 feet and the Falls of Arve of 1,100 feet are certainly higher than the Falls of Gersoppa 850 feet.

In the Falls of Niagara a river two miles across contracted to less than half of its normal breadth, is precipitated over a height

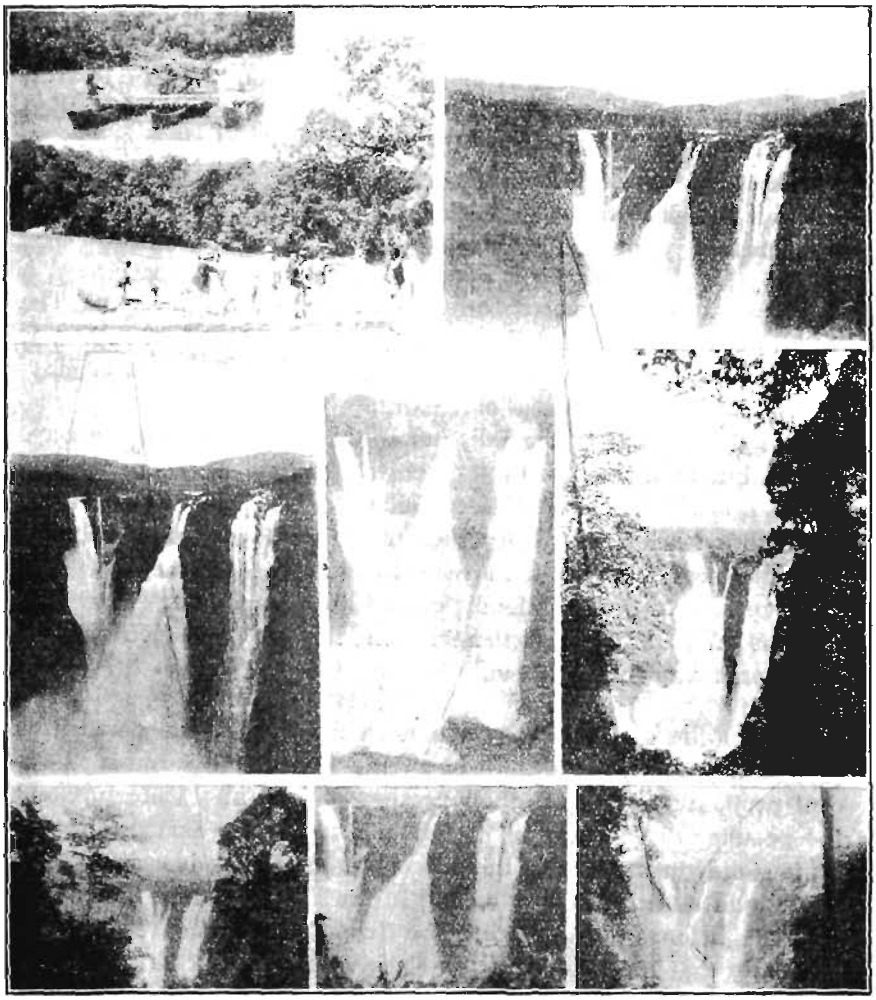

Fig. 39. The Gersoppa Falls.

of 164 feet in two horse-shoe shaped falls the volume and grandeur of which the Gersoppa cannot hope to beat. But L. Bowring says, "It may truly be called one of the wonders of the world, for al-

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though the volume of water is less than that of the Cauvery, the immensity of height is almost without a parallel."

" The water comes down in four distinct falls, presenting a scene of transcendent grandeur and sublimity, whose effect is greatly heightened by the wild and beautiful country around abounding with a wealth of luxuriant vegetation. The Raja Fall pours in one unbroken column to a sheer depth of 830 feet. (This has been variously called Grand Falls, the Main Falls and the Horse-Shoe Falls). Half way down, it is encountered by the Roarer, another fall which precipitates itself into a vast cup and then rushes violently at an angle of 45° to meet its famous compeer. A third fall the Rocket, shoots downwards in a series of jets; while the fourth called the Dame Blanche is an Undine-like Cascade gliding quietly over the mountain side in a sheet of foam."

The bed of the river is formed by the archaean gneisses. The cauldron of the Rajah Fall is a sight worth seeing by itself. It is shaped like an unsymmetrical C with the Raja and Roarer occupying two sectors. The bare cliff exhibits the gneissic banding distinctly. The bottom of the falls below the Raja Fall is not always visible, but at certain times it is clearly visible. The depth of the pool is said to be over a 150 feet. Below the falls is a deep winding gorge 18 miles long through which the river slowly winds its way. The smallness (size) of the stream in the gorge as compared with the river above the falls lends colour to the popular view that there is an underground channel from the pool to a point in the river some way further down.

The Falls of Gersoppa have been figuring in the papers for some time past in connection with the Mysore Government's recent proposals to harness their portion of the Falls. Unfortunately the peculiar distribution of the Falls between the British and the State stands in the way of the scheme materialising just at present. The Rajah and the Roarer belong to the British, while the rest of the Falls belongs to the State. The British Government's objection is mainly that the beauty of the Falls would be lost if there were to be a dam constructed to take away a portion of the water. The State by a series of trial experiments had come to the conclusion that it is possible to harness the falls without in the least robbing off its beauty.

It is needless to say what such a scheme would have in store for the development of Mysore especially with the industrial centre

of Bhadravathi within easy reach. The materialisation of the proposal together with the proposed harbour for Mysore would go a long way in forging ahead the development of the iron industry at Bhadravathi. From the Falls we returned to Bhadravathi.

Bhadravathi holds a very important place in the industrial world of the British Empire. The Mysore wood distillation and Iron company's plants are situated here. The blast furnace with a total daily output of 60 tons pig iron is of the American type and uses charcoal for reduction purposes and among such charcoal blast furnaces it is the largest in the British Empire. The prosperity of Bhadravathi is in no small measure due to the foresight of Sir M. Visweswarayya, the brain behind the whole thing; and it is founded on firm foundations—as the iron ore at the Bababudan hills alone, it is said, at the present rate of consumption would last for more than a hundred years and iron ore is available at other places too; limestone and dolomite are quite in abundance and lastly the thick forests of eastern slopes of the Malnad provide the necessary fuel. The prospect of the Jog Falls being harnessed in the near future lends further strength to the scheme which had been boldly launched by the State.

Bhadravathi a modern town which has grown on the left bank of the perennial Bhadra, a head stream of the Tungabhadra, is a well-planned town, well-equipped with electric lights, filtered water, club, tennis courts, etc., and offers a striking contrast to the old town of Bankipur on the other side of the river, with which it is connected by a masonry bridge. The Mysore Iron Works are the pulsating heart of Bhadravathi and the new town owes its existence to it. All the people earn their living from the Iron Works and it is a counterpart in South India of Jamshedpour.

PROCESSES OF IRON MANUFACTURE

Iron does not occur in nature in the metallic condition (except as meteorites), but is largely obtained from a number of its ores. The quartz haematite schist capping the Bababudan hills is the basis of the Mysore Iron Works. The ores are mainly haematitic with a certain admixture of limonite and ochre but no magnetite. This together with a certain amount of siliceous haematite is brought from the foot of the hills in wagons along trolley lines and mixed with a certain amount of limestone and charcoal (prepared locally) and the blast furnace is charged with this mixture. The furnace is heated by means of hot air blasts which are themselves

heated by the flue gases. The blast furnace is heated to a temperature of 1500° F at which temperature certain complex reactions take place within, giving as end products metallic iron (pig iron), calcium silicate (slag) and a mixture of CO_2 and CO. The molten iron settles down to the bottom of the furnace and is drawn off at intervals of 6 hours ; the slag which too is in a liquid condition is lighter than the metal and hence floats on the surface of the molten iron and so comes last and is diverted into a separate place where it is allowed to cool. The molten pig iron is allowed into channels made in sand and is allowed to cool there. The furnace works throughout day and night and the sight of molten iron with its liquid glow is simply grand during the night time. It lights up the whole works with a weird red hot glare which made us recall our conception of hell.

The pig iron drawn from the furnace is cut into pieces while yet in a plastic condition for handling in the subsequent stages. The pig iron thus formed is then passed to the foundry where it is remelted and cast into an innumerable number of things—things which include pipes of several sizes, iron fencing, gates, lamp posts, sign boards, name plates of towns and villages, etc. The foundry building is equipped with several costly appliances such as electric smelting furnaces, lathes, punches, drills, electric cranes which lift up huge cupolas or crucibles containing the molten metal, carry it from place to place and lift it into the moulds. By the operation of a lever the operator does the work of many men and that too within a fraction of the time required by human labour.

The Iron Works use scrap iron also in addition to the pig iron got from the iron ore by reduction. The scrap iron pieces are lifted by an electro-magnetic crane and put into another furnace where it is smelted. The molten metal drawn off in huge buckets is hauled up and taken to pipe casting sections by an electric crane.

Associated with the Iron Works at Bhadravathi one should note the following : the charcoal batteries, the apparatus for the separation of the by-products of destructive distillation and creosoting plant ; the air pump, and the power station.

The wood from the forests around Bhadravathi brought by trolleys is packed in a steel carriage and pushed into the battery chamber the walls of which are lined by fire bricks made from local aluminium silicate. The chamber is heated by the burning of carbon monoxide from the gaseous by-products. The chamber is then closed by the double door and the wood allowed to remain

there for a certain period. During the period the hydro-carbons and nitro-gaseous compounds escape as gases leaving the pure carbon in the form of charcoal. The gaseous by-products contain among other things carbon monoxide CO which is separated and used for heating the battery. By a process of differential distillation a number of liquid products of varying density are separated chief among which are ammonia (separated as am. acetate), wood tar, wood alcohol, heavy wood oil and creosote. We were told that the by-products of the charcoal battery were more paying than the iron industry itself.

Creosote has got a peculiar use for it there. It is used for the creosoting (coating with creosote) of logs of wood for use as electric posts. The creosoting process hardens the wood and makes it less liable to rotting.

Attached to the works are two pressure pumps which pump air into the 4 hot air stoves. The stoves which look like iron cylinders are lined on the inside with fire bricks. The flue gases consisting of a mixture of carbon monoxide and carbon dioxide is allowed to burn here and heat the walls, and the air in contact with these heated walls get heated thereby. This use of the flue gases serves a double purpose (i) that of heating the hot air stoves with the minimum of expense; (ii) and the more important one than the first is that it thereby prevents the carbon monoxide from contaminating the air with its poisonous qualities.

That night we bade goodbye to Bhadravathi. We would have liked to remain there for some more time and enjoy the privilege of going up to the ore mountains through some of the most beautiful natural scenery associated with Mysore, were we not pressed for time on one side and the pinching of our pockets—a more potent influence—on the other side. The next morning we arrived at Mysore in good spirits. Our sick list was replaced by a list of good spirits.

MYSORE

The first impression that made itself felt on us was the hotter climate of Mysore. It was not so bracing as at Bangalore. The second impression was that caused by the buildings, roads, lights and the general lay out of the city as a whole which offered a striking contrast to that of Bangalore—a contrast which made itself more impressive as we saw more and more of Mysore. Mysore and Bangalore are both built on undulating platforms but the undula-

tions are milder and more subdued in the case of Mysore than in the case of Bangalore. The curving roads of Bangalore were absent in Mysore, where they are straight, broad and less steep, and arranged in a rectilinear fashion, cutting the city into a number of rectangular fragments—a feature which recalls the plan of Pondicherry.

Mysore is essentially a city of palaces and guest houses; and Bangalore a city of parks and picturesque suburbs. The importance of Mysore is the fact of its being the capital of the State; while Bangalore is the administrative capital.

MYSORE DUSSERAH EXHIBITION

The Dusserah Exhibition is nothing but a Park Fair Exhibition, but we could notice a peculiar feature as regards this. The exhibits on the electrical side, ivory section and toy (wooden) section formed the largest part of it. To a casual observer it would mean nothing. But, to a trained eye it was a meaningful sight. The electrical appliances had to be associated with electrical developments, the ivory works with the elephants in the state forests of Mysore and wooden toys with the industry of Chennapatnam. The exhibition was styled the All-India Exhibition; but to me it looked typically a Mysore exhibition. I could not help associating the manufacture of incandescent mantles by an Indian gentleman, an assistant of Dr. Sir C. V. Raman with the geographic surroundings —the progressive state with many practical ideas, practical and original methods and the halo surrounding the name of Dr. Sir C. V. Raman. The mantle is claimed to be one step better than the best mantles we could get till then.

Chamundi Hill. The Chamundi Hill formed the item in our programme for the 28th morning. The distance of 2 miles that separated the foot of the hills from the hostel was done on foot, though to begin with we were given hopes of a tonga ride (which hope carried us to the foot). The Chamundi Hill is an example of the number of gneissic hills that are scattered all over the plateau. It is lenticular in shape with the axis of elongation in an east to west direction and gradually increasing in elevation from east to west. At the top of the hill are situated the Chamundeswari temple and the Maharaja's palace. Chamundeswari is the patron deity of the Mysore royal family and is also known as Mahishasuramardani from which the name of the city itself is derived. From the top of the hill one gets a full view of the sur-

rounding country, and traces the development of the city in several directions. The city itself is at an elevation, with respect to the surrounding country. But within the city itself the development has been on a scientific basis. The sites of buildings like the palaces, guest houses, the aerodrome, etc., are on higher grounds, the lower ground being utilised for gardening purposes. As we were going to the foot of the hills from the city, we had a lake to one side of the road while on the other side there was a garden with cocoanuts and other vegetables in the lower level.

Beyond the city of Mysore, the land falls in height, rapidly in the direction of the Cauvery. In this direction one could see one continuous green patch. In all other directions there was the alternating ups and downs characteristic of the Mysore plateau with the slopes covered with fields and the higher ground covered with scrub jungles.

With a sweep of our eyes we could see the Nanjangod hills, the distant view of the Nilgiris and the line of hills that mark the eastern edge of the plateau—the eastern ghats.

Midway between the foot of the hills and the top is a huge monolithic bull about 12′ to 14′ in height. It was smaller than that of Tanjore and, I was told, than that of Lepakshi also.

There is an excellent motor road going up the hill and one could get to the temple gates in a car. The road begins the ascent from the eastern end of the hill and after a number of zig-zag bends arrives at the top after a length of 6 miles.

The sight of the hill is grander during the night than in the day time, as the lights arranged along its crest appear against the dark background as a line of bright stars.

The importance of the hill is in its temple and the palace. The temple is the counterpart of Tirupathi; and every year thousands of pilgrims flock to see it. But it also forms an item of interest for tourists to Mysore, especially so during Dusserah when millions of people go to Mysore and not a few like us pay a visit to the hill, the temple and the palace. This ever present stream of devotees and visitors has given rise to a number of shops lining the way —sweetmeat shops, tender cocoanut shops and shops where one can get things for performing archana. These shop owners depend on the generosity of the people that come there and we also in

that capacity contributed to the sale of some 30 tender cocoanuts. The beggars also ply their trade here in large numbers.

After spending our morning on the hills we came back to the hostel at 11 A.M. That evening we had some difficulty in arranging for our conveyance to the Kannambadi dam and Seringapatam, but thanks to our luck, of which we have had our usual share, we managed to arrange for them. We were packed up, 14 of us including some heavy weights, in two 5-seater cars. But the objective was worth this inconvenience.

The journey from Mysore to Kannambadi is also a continuous down gradient and the features of the land which we had noticed from the eminence of Chamundi, we could corroborate now from close quarters. There was an impression among some of us that the inclusion of Kannambadi dam into our crowded programme knowing full well the short time at our disposal, was nothing short of having no sense of utility, no discretion and no idea as to how best to utilise the short time at our disposal. But impression vanished into thin air when we saw the beautiful fountains and gardens below the dam.

The Krishnaraja Sagara Irrigation Scheme of which Kannambadi dam is a unit has been one of the engineering achievements of the world of to-day and of epic importance to Mysore.

The Cauvery at the site of the dam flows in a valley between two hills while higher up there is natural high bund on either side. The idea of a dam is not of the modern times—it is said that Tippu Sultan actually began the construction of a dam at the present site —but it is the practical undertaking and successful completion of the scheme that is to the credit of our 20th century, a credit which goes to the grand foresight of Sir M. Visweswarayya. The river was dammed at the narrowest part of the valley and the waters of the Cauvery thrown back to form a huge lake of over 7 sq. miles in area and with a maximum depth of about 120′ just behind the dam. To feed the Cauvery below the dam a number of sluices have been constructed which when open throw jets of water 25′ away. Associated with the dam are other irrigation canals. The sluices are all operated by electricity. There is a road right along the dam so that it is possible for motorists to pass from one side to the other in the car itself.

But the most creditable thing, which is typically Mysorean, is the way in which they have made it an object of attraction. The

fountains and the gardens just below the dam cannot be adequately described in words. One should go there, sit and watch it for hours till one is practically fed up with it, which is not so easy. It is this association of a sense of artistic beauty with all their undertakings which I call typically a Mysorean characteristic. I have forgotten to mention one thing. Here again, as in the case of Sivasamudram the mad fury of the rushing waters can be harnessed for the production of electricity. Turbines and generators have been erected here to supplement (and as a reserve in a case of emergency) the Sivasamudram power works.

The taxi took us then to Seringapatam which place was reached at about 5-45 P.M. The number of items to be seen were many but the time at our disposal, 30 to 45 minutes, was too short so that we were compelled to fly through the items. But this flight has done some of us some good. It has left such lasting impression of the few things that we saw that it has given birth to a burning desire in us to go to these places once again and complete our sight-seeing and the reconstruction of the unrelated facts.

The first thing that we saw was the Fort. We entered it through the Bangalore gate and caught fleeting sights of the ruins of the one time stronghold of Tippu Sultan. Our destination was the swinging bridge, the De Havilland arch. Arrived here, we raced to the top of the bridge and jumped—the bridge slowly and majestically swinging. The bridge is a masonry construction and the cause of such swinging phenomenon in such a masonry construction has been the subject of discussion among scientists and engineers but no definite conclusion seems to have been arrived at yet. History goes to say that a certain French engineer in the service of Tippu Sultan built this to show his skill in engineering and Tippu rewarded him by cutting his thumb away so that it may not be of use to others. We rushed through the temple and then in the taxi we sped along the road to Daria Dowlatt. It was this that made us regret our inability, due to shortness of time, to enjoy the sight to the full. Of the internal beauties we could see very little, dark as was the interior, made darker still by the lateness of the day. The pool in front and the avenue along on either side of the pool brought before our mind a similar sight in the Taj Mahal. The situation, on the banks of the Cauvery, the beautiful parks and gardens bring the similarity much closer still.

From here we motored to Gumbaz to see the tomb of Tippu and Haidar. The architecture of this was beautiful like that of the

Daria Dowlat and we could only curse our stars for our inability to come earlier and have the benefit of taking some photos to help our mental impressions.

We slowly wended our way back towards Mysore which place we reached at 7 o'clock. A most spectacular sight was awaiting us. Some of us had a partial view of the palace lighting but the sight which was in store for us astounded us all. We could not see the building of the palace but the whole of it was covered and lit entirely by brightly coloured electric bulbs. There would have been some millions of these bulbs and the light of all these threw a lurid white haze in the sky which is strikingly and beautifully observable when there are some clouds. We have heard of flood lighting and other such phenomena in western countries and this is the South India counterpart of them. Such a huge consumption of electrical energy is made possible by the cheapness of electricity which in its turn reflects upon the foresight and thought of Mysore's Dewan in the development of Sivasamudram power.

A huge crowd had collected in front of the durbar hall to see the durbar that was in progress while an enormous stream of people was passing in and passing out through the gateway to gaze at the lighting of the palace. We too followed the stream and were making our way to a point of vantage wherefrom we could have a close view of the durbar but the fury of a passing crowd forced us back to the entrance and being caught in the stream we had no other go but to leave ourselves to their charge and get out, much as we liked to get in and catch a better glimpse of the lighting and the durbar. That night we returned to the hostel with our minds full of visions of the palace lighting.

Zoo. The next morning was spent in going round the zoo and the Jagan Mohan Palace Art Gallery. The zoo will be an eye opener for the person who has visited only the Madras managerie because of the wealth of animals and the name and habitat of each written on their cage. There are so many species that are present there which have their habitats in India but which we do not know that it is really an eye opener shedding light on the wealth of the Indian fauna. The attempt of the authorities concerned in giving conditions similar to their natural habitat is a pleasing factor and reduces the quality of the sin committed in depriving them of their freedom.

The Jagan Mohan Art Gallery contains one of the finest collection of Art pictures, paintings and the like. There is much of local history in the pictures there.

The evening of the 29th, the last day of our stay at Mysore, had in store for us the grandest spectacle (barring Gersoppa) of the excursion. The procession is said to be unique of its kind in India and people from far and near including hundreds of Europeans congregate to the city to see this. This is the concluding item of the Dusserah festivities; and this over, the curve changes. The constant influx of people into Mysore gives place to an efflux, an efflux so rapid that it is impossible to get accommodation in the trains. The procession consists of a long march past of the Mysore regiment followed by the state officials of importance preceding the Maharaja, the Yuvaraja and the heir in a gorgeously ornamented elephant, the relatives of the Royalty followed by the vanguard bringing up the rear. The day is one on which all the people pay their homage to the Maharaja. The numerous offerings to the Maharaja by the peoples and the thunderous cheers which the Europeans gave, are still dancing before my eyes and ringing in my ears. The procession would be a mile in length.

The more fortunate members of our party had the good luck of going to the destination of the procession and enjoy the sight there, but I happened to be one among the unlucky lot and did not have the privilege of seeing that.

The night of 29th saw us off from Mysore. The amusing incident that happened at the station we can never forget. All our things were inside in a reserved compartment, tickets had been purchased and two of our party were there but the rest of us could not get in, in spite of the fact that we had the tickets with us. It was then that our host Mr. N. S. Subba Rao turned up. He went and brought an Inspector to lead us in. A charge to the left, an elbowing to the right and a passage was made for us in the surging crowd at the entrance and then the gates were opened wide to admit us in.

The distance of 82 miles was done leisurely enough and we arrived at Bangalore city at 6-30 A.M. We were all looking forward for a happy time at Bangalore and had already drawn up programme for the day, when down came the news like the bolt from the blue that we were going direct to Madras. We had no other alternative but to accept it and so we entrained for Madras. The disappointment had robbed us of much of our spirits, and the

thought of our being in the Madras train, and that we were going back ' to home, sweet home,' made us home sick and induced in us a sense of expectancy. The party was unusually silent, the punster was lacking in his ready wit and humour. The silence and the home sickness made the time dreary and the members spent the time as best as they could either in reading something or simply dozing. We arrived at Madras at 2-10 P.M.

Synthesis. Mysore consists of two regions, the malnad and the maidan. Before the tour we had only very vague notions—partly untrue—of the malnad. We took it to be only the western extension of the maidan proper, an extension into a region of heavy rains of the monsoon track and consequently forested. The true picture of the malnad dawned upon us only when we traversed the region ourselves. The maidan, as has already been seen is a region of gentle undulations intersected by a line of hills—the rounded boulder hills of the gneissic rocks. The downs are clothed with cultivated fields growing cumbu and jowar generally, with palms as the natural vegetation while along valley axes and immediately below lake bunds irrigated paddy and cocoanut palms replace the other crops. This type of irrigation—bunds across the river with artificial tank formation holding up and storing up water during the rainy season for use during the dry season—is characteristic of a large part of Mysore (In this connection I have to notice the peculiarity of these bunds in Mysore state.) The wetter western regions of the maidan concentrate on areca palm, and travelling near Birur we could see large plantations of areca palm and cocoanut palm which has made Birur a very big areca nut centre. The ' ups ' are all clothed with lantana which dominate over all other kinds of vegetation up to Birur beyond which the increasing rainfall gives rise to wooded areas.

The malnad also in a general way consists of ups and downs but the gentleness of the profile of the maidan gives place to sharper angles. We have steep slopes and deep valleys taking the place of the gentle ups and downs. The way in which the land is utilised here offers a striking contrast to that of the maidan, an explanation of which is not far to seek, if one understands the climatic conditions. A fertile soil and perennial streams clothe the valleys with verdant cultivation. The rising hill slopes are beautiful with tall waving trees of the tropical monsoon forests which at some place offer light and shade enough for hidden plantations of coffee. Higher up are grassy downs giving the appearance of velvet covered side from a distance. Above all the gigantic mountains

rear up thin heads majestically into fantastic peaks. Human dwellings are few and far between. A cottage here and a cottage there situated picturesquely amidst wooded slopes bordering the fields growing unirrigated paddy, sugarcane or areca palm or plantain represent the homestead of a farmer and his family. Towns there are none and villages are few and far between. "The incessant rain confines the people to their homesteads and farms and hence each householder is tempted to surround himself with all his necessities and succeeds to a large extent in making himself independent of the external world." Such is the malnad and how strikingly it would differ from the maidan one could gather if he visualises the two.

Carrying the analogy of the ups and downs farther we can compare the east and the west coast with the two regions noted above.

The eastern plain (meaning the region to the east of the plateau rim—the Eastern Ghats) consists of the same ups and downs which gradually becomes milder in profile till it is a level plain along the coast. The plain portion and the downs are all clothed with cultivation, the character of the crops varying with the climatic conditions while the higher regions are wooded areas, mostly of the scrub jungle type. The population is more or less evenly distributed but with a tendency to concentration on the plains.

On the west coast also the same features are repeated as in the three preceding regions but the valleys or the downs are drowned, the higher lands remaining as land areas proper of the west coast. The drowned valleys form the backwaters of the Malabar coast, the influence of which on the life of the people is of far-reaching importance.

Thus, in the four regions noticed above, the generality of configuration of the land is the same, the difference being one of degree rather than of kind. This change in degree of the physical configuration coupled with local conditions of climate, etc., have been instrumental in giving rise to different response in the several regions. The thickly (relatively) populated and rich (agriculturally) eastern and western plains are different from the relatively less populated maidan and the thinly populated malnad. In the malnad one longs to see more people while in the west and east coasts, the people resort to seclusion or a quiet life as a variety to relieve the dead monotony of life in a crowded city.

Secondly, what struck us most was the co-ordinated character of the industries and the admirable way in which the natural resources have been profitably utilised. We have already seen only one instance of this co-ordination, namely, the relation of the porcelain factory to the hydro-electric development. The cheapness of electricity has given rise to a large number of industries, cottage industries mostly, but which have been developed on wise lines to ensure co-operation between the cottage industries and the hydro-electric development. This co-ordination has made it possible for the cottage industry to exist side by side with electric development, a feature to which one cannot give credence at first. This is revealed in the Chennapatna toy works, silk factory, etc. Rural development has been facilitated very much by electricity as one sees in the South and South-East Mysore. In fact one can say " Electricity has metamorphosed South and South-East Mysore." This programme of development on electrical lines is to be applied to the North-West corner of Mysore in the near future, if the Mysore State's project is materialised.

We have already seen how the State makes use of its resources in Kaolin, quartz and felspar in the preparation of electric insulators with other porcelain ware as by-products. Another instance of a similar case is the iron industry. The forests are utilised in the manufacture of charcoal for the reduction of iron ores and this process of charcoal making yields a number of by-products included among which are alcohol, acetic acid (cal. acetate), tar, ammonia and creosote. The ammonia is won in the form of am. phosphate which is utilised as a manure. The creosote is used in a novel way. When wood is impregnated with this compound, it protects it from attacks of insects and decay. This property of the creosote is taken advantage of in utilising the forest resources for the development of electricity. The giant trees of the forest are cut and subjected to a process of creosoting (the logs are placed in a chamber into which creosote is let in a vapourous condition) whereby creosote is impregnated into the logs and thus ensures their long life. Such posts are used as posts for carrying the power cables as in the case of the Sivasamudram-Kolar line, the Sivasamudram-Bangalore line, etc. This finds a use for the giant trees of the forests and at the same time reduces the huge capital expenditure which the employment of iron posts would entail. The cheapness of electricity has been well utilised as in the beautification of Mysore. This sense of beauty and a taste for artistic things is well seen in Kannambadi where we have the gardens and the fountains, in Mysore which is even ordinarily artistically

illuminated and more so during the Dusserah period. All these things of the "electrical state" have electrified our imagination and provided us with a new sense of perception and a new angle of vision.

Thirdly, the Mysore authorities are anxious to let people know about their achievements. They do not put any sort of restriction whatsoever in the matter of visiting their works. We could not understand at first how the large number of ordinary people are given permission to visit the power station at Sivasamudram and then again at Bhadravathi. It was at Bhadravathi that we came to know of this. Our host explained that it was their policy to let people know about things popularising their works, a policy which would not be practicable if they were to restrict admission to selected few.

Conclusion. To conclude, I cannot find words to express my joy, my thankfulness and my gratitude sufficiently. The tour was a complete success, thanks to our luck which would never leave us even if we were prepared to leave it. The excursion was in the nature of an experiment, upon the success of which the recurrence of this item in the years to come depended. We have the proud privilege to say "we are the members of the first experimental tour" for the grand success of the item is due to the conjoint influences of all of us and of which one can rightly have his share and be proud of it. Each of us have our own joys but the joy of our sisters should be beyond all bounds for the opportunities offered to them, for such an illuminating excursion are few and far between. The most noticeable feature was the family relationship that existed among us. We were like several members of a single family and did not feel like strangers at all. This is an important attribute to educational tours, that they have a high social value besides the practical and educational values.

Finally, I cannot but conclude this attempt of mine without a word about Mr. Subrahmanyam, our leader. He was not a professor there. He was treating us more like his own sons and daughters than like students. May God give him long life and prosperity !

News and Notes

It is regretted that this and the previous number of the Journal were considerably delayed in their publication, owing to causes beyond the control of the Editor. Steps are taken to see that such delays are not repeated.

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Mr. V. Krishnan, who was appointed to carry on the Regional Survey of Tiruvallur on behalf of and under the guidance of a Committee of the Association, has since been awarded a Research Studentship of the Madras University for continuing and completing the work, thereby relieving the Association financially. During the period of over two months when he worked for the Association, he collected data and prepared maps of land utilisation, crops, etc., of a few typical villages in the Tiruvallur Region. A Report of the Committee will be published in the next number of the Journal.

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The excursion to Mysore, the programme of which was published in the July issue of the Journal, was quite a successful one. A detailed account of it by one of the members of the party, Mr. V. Kalyanasundaram, is included in this number. It is proposed to conduct a similar excursion this year also. The place, time and other details will be notified in due course.

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The two suggestive syllabuses published in the July issue have evoked a general interest in the lower and middle school work in Geography; and there have been several inquiries about them. In this connection we wish to point out to teachers and headmasters that there ought not to be a single stereotyped syllabus for the middle school classes, where the iron hand of uniformity should not be laid as in the high school. In the latter case, there is the excuse of the great need for a common examination. There should therefore be elasticity and local option to try and work out any reasonable syllabus. The real emphasis ought to be on the principles to be kept in view in the choice of topics and on the method of treatment. The Departmental Syllabus is out of date and out of print; and in revising the same, it is hoped that two or three

alternative syllabuses will be issued as suggestive of the kind of work to be done, incorporating the main principles.

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It has been decided not to have a Summer School of Geography during the coming summer holidays as in previous years, but to hold a Refresher Course, preferably for teachers of middle school, later on in the year, either during the Michaelmas or Christmas holidays. The details will be notified after they are settled.

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The Fifth Conference of the Association will be held at Anantapur during Christmas Week, when papers on various aspects of the Geography of Anantapur District will be read by specialists, each in his own line.

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The S.S.L.C. Scheme and Syllabuses are again in the melting pot with scarcely any decent trial given to the existing scheme. The position of Geography in the proposed reorganisation is, of course, theoretically not worse than that of the other long-standing subjects of the school curriculum. But actually its position is bound to get far worse, owing to the fact that no men's college and only one women's college has provided for the teaching of the subject at the Intermediate stage. C Group Geography in the High School has consequently been a blind alley, which few have cared to enter; and when the A Group Geography goes shortly, its reactions on the importance of the subject are bound to be very adverse.

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In this connection we wish to reiterate the great desirability of the Educational Department and some private managements of colleges taking immediate steps to provide for the opening of Geography at least in the Intermediate course, leading eventually to the Degree course in the subject, which at present has only a paper existence in the University Calendar. There is a false fear in some quarters that the equipment for it will be a very costly affair. But we can assure that an institution can start the subject with a minimum equipment within less than a couple of thousand rupees. And as for the staff, we have had for two years the Diploma Course in Geography, which has supplied among others Honours Graduates in Science and Humanities who have taken the Diploma in Geography with distinction, and who are, therefore, competent and

qualified to handle the subject at least in the Intermediate classes. The half a dozen institutions that once started Geography in the Intermediate Course and were forced to close down for want of the qualified teacher can no longer have any excuse for not reopening it now.

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We are glad to find that the modern type of questions, which has long been urged for adoption in the S.S.L.C. Examination, has been definitely accepted by the Board; and model questions have been issued in all the subjects. In Geography more than in the other subjects of the S.S.L.C. Course, the effect is sure to be beneficial, as otherwise it will not be possible to have a valid and comprehensive testing by an hour's question paper on three years' study in the subject.

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Most of the branches of the Association have not been showing signs of life ; and some of them had to be closed down as those of Chittoor, Erode and Nellore. But Vizagapatam and Coimbatore branches have been exhibiting steady activity. The former has contributed a number of important papers, which have been published in some of the back numbers of the Journal. The next issue will contain two papers read before these two branches.

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There are several useful ways in which branches can carry on and contribute to the work of the Association. Studies on their immediate environment from various points of view may be made by members and others and read before the branch, and subsequently published in the Journal. Excursions, lantern lectures, model lessons, discussion of syllabuses, collection of local data regarding weather conditions, economic facts, etc., for publication in the Journal are some of the other important ways in which branches can function usefully.

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The Journal completes its eighth volume with this issue. With increasing the size of each number to more than double what it was at the outset, and as a result of adopting linotype printing and superior get-up as well as on account of the large cost of the numerous maps and diagrams, it has been found very difficult to make both ends meet. We, therefore, appeal to such of the non-journal members as can afford it to go in for the Journal, and to the journal members to secure fresh subscribers, both in the shape of members and of institutions,

Reviews

The Making of Geography. By R. E. Dickinson and O. J. R. Howarth. (Oxford University Press). 264 pages. Price 8sh. 6d.

This book treats of the growth of man's knowledge about the earth and of the progress of geographical science from the first surmises of the Sumerians, Egyptians and Homeric Greeks to the most modern developments of physical and human geography. The journeys of the great explorers and travellers of all ages are mentioned in relation to the advances in geographical theory to which they led. But the book is more concerned with the building up of the geographical science on the results of exploration, rather than as a history of exploration itself.

Of the two collaborators in this work, Dr. Howarth who has done the earlier chapters has gone into the subject of ancient and mediaeval development of geography in a comprehensive manner. But most readers of the book are likely to be more interested in the later chapters by Mr. Dickinson, which deal with the growth of modern geography from the Age of Discoveries with the advance of the physical and natural sciences in modern times. Especially interesting is the elucidation of the work of Humboldt and Ritter as the progenitors of modern geography, and of Lyell and Darwin who contributed to the development of physical geography by establishing the doctrine of *Evolution* in their respective inorganic and organic spheres. In the chapter on the development of human geography the doctrine of *geographic determinism* of Buckle, Ratzel and Semple and its subsequent modification into the '*possibilism,*' of Vidal de la Blache, Brunhes and Febvre have been explained very clearly. In the chapter on Regional Concept, the development of the regional idea has been traced to the work of Dr. Herbertson, who approached from the world whole, dividing it into major natural regions, and that of Vidal de la Blache and his disciples, who insisted upon the study of " relations between geographical conditions and social facts viewed at close quarters, in a well-chosen and small field " as an antidote to the danger of large generalisations.

The publication is an interesting and scholarly work; and it is illustrated with a number of diagrams, showing the salient

features of famous maps, and examples of early astronomical and survey instruments.

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Principles and Practice of Geography Teaching. By H .C. Barnard. (London, University Tutorial Press, Ltd.). 234 pages. 4sh. 6d.

This latest book on the teaching of geography falls roughly into two parts. The first part consisting of chapters I to VII deals with a discussion of the scope and content of school geography, teaching aids and equipment, and syllabus and methods. The second deals in detail in chapters VIII to XI with Regional Survey as applied to geography teaching in schools; and this is a special feature of this book. The last chapter (ch. XII) discusses in a broad way the educational and other values of a study of geography in schools; and this is followed up by a short but very useful descriptive list of books on the teaching of geography. The book is simple and clear in treatment, comprehensive in scope, and interesting and serviceable, and can strongly be recommended for use in Training Colleges by graduate students specialising in the teaching of geography.

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Longman's Senior Atlas for India. Edited by George Philip. (Longmans, Green & Co., Ltd., Calcutta). 64 pages. Price Rs. 2.

This is a good Atlas at a moderate price, edited by the well-known cartographer and map publisher, Sir George Philip. It fills a gap between cheap but meagre school atlases like the Taj Mahal and other atlases of the High School standard and the advanced but costly atlases like Philip's New Systematic Atlas and Oxford Advanced Atlas. Having been specially prepared for use by Indian students, it contains a number of special, sectional and historical maps of India as well as systematic maps of each of the continents.

Among its other useful features are a section on Projections and Principles of Relief, Recent Statistical Data with diagrammatic representations of the same, Economic Maps showing world distribution of important crops, minerals, etc., Scale illustrated with reference to maps of a part of India in different scales, astronomi-

cal diagrams, world maps showing rainfall, pressure, winds, ocean currents, vegetation, population, communications, etc., and a useful index with pronunciation of the place-names and including a large number of Indian names such as Conjeevaram and Villupuram, not to be found in other atlases.

Altogether it is quite a useful companion to students of geography in High Schools, and even to those in colleges who desire to go in for a cheaper atlas than Philip's New Systematic Atlas or Oxford Advanced Atlas.

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Oxford School Atlas (Tamil and Telugu editions). By John Bartholomew. (Oxford University Press, Madras). Pages viii + 24. Price annas 12.

One of the chief difficulties in the way of using the vernacular medium in the teaching of geography in high schools has been the absence of a good and cheap atlas in the mother-tongue. The Oxford University Press has done a great service for the cause of vernacularisation by bringing out a Tamil and Telugu edition of their School Atlas for India; and in doing so they have carried out several additions and improvements.

Among its useful features may be mentioned a map and picture of land forms for comparison, population statistics of provinces, states and cities as per 1931 census, varieties of map representation, a section on map projections and another containing astronomical diagrams, systematic maps of the World, Eurasia and India, economic data of exports, imports, etc., and length of important rivers and height of chief peaks of the World given diagrammatically.

The lettering on the maps is clear, neat and graphic, and free from overcrowding of names. But the absence of an index has to be noted as a chief drawback. The publication is a marvel of cheapness; and it can be strongly recommended for use not only in middle schools and elementary training schools, but also in those high schools where the vernacular medium has been adopted for the teaching of non-language subjects. We hope that the Publishers will soon follow this up with bringing out Malayalam and Canarese editions of the Atlas, for which we are sure there is an equally insistent demand.

Map of Madras Presidency (in Tamil) 36 inches by 24 inches. Scale 1 inch = 27 miles approximately. (Christian Literature Society, Madras). Price Re. 1 As. 4.

This wall map of Madras Presidency shows the divisions into districts and the several communication lines—roads, railways and sea-routes, in a clear and graphic way without any over-crowding of the lines and features. Only the essential names are given, and the size of the lettering graduated according to the importance of the place, so that the effect is very pleasing and the map consequently attractive. Mountains and mountainous parts have been shown by simple shading.

An inset map of density of population adds to the usefulness of this cheap and serviceable wall-map, which ought to find a place in every elementary school.

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Geography of the Madras Presidency (Malayalam). By N. Subrahmanyam. (Longmans, Green & Co., Ltd., Madras). 118 pages. Price 6 annas.

This is the Malayalam version of the Tamil book by the same author, reviewed in a back number of this Journal (Vol. VI, Nos. 3-4) and of the Telugu edition reviewed in Vol. VII, No. 2. We quote from the earlier review the following opinion, which applies to this edition also. "Reform in the teaching of geography has hitherto been practically confined to the High School; and books meant for children in the lower school have hitherto been of the old world type. It is, therefore, refreshing to find that an expert in the subject has brought out a Geography of the Madras Presidency on modern lines for use in the fifth standard or class. The language is clear and simple, and the method descriptive. The matter is fuller than in similar publications; and the regional method has been followed in a modified form. The book is well illustrated by a large number of maps and pictures, and the get-up is neat."

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The Atlas Geography of the Tanjore District (Tamil). By G. V. Rama Ayyar (G. V. K. Swami & Co., Kumbakonam). 40 pages. Price annas 5.

This text-book of local geography for Tanjore District differs from the usual lot of them by putting greater emphasis on map

study, which has been made a special feature; and the subject-matter has been presented in a simple and lucid manner. The book is illustrated with a few pictures; and the type is bold and attractive.

But we have to take exception to the logical treatment, as if for adults, in this as in so many other local geography books. We feel strongly that books on geography meant for children should treat the subject in a *regional* and *descriptive* way with the approach from the home and the viewpoint of the child.

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Geography of the Bhimavaram Taluk (Telugu). By S. Peri Sastry. (Venkata Ram & Co., Ellore). 80 pages. Price 3 annas.

This is one of the better books of local geography—chatty and interesting—but written on old lines. Though the author *says* he means it to be used more by the teacher, he addresses it primarily to the pupils; and for pupils' use, the logical treatment as if for adults and the inclusion of lessons on history, astronomy, etc., of the area (however useful otherwise) are features to be deprecated in a modern book on geography meant for the use of children. Though the type is bold and the book contains several useful maps, diagrams and pictures, we wish the treatment were more on present-day approved lines—*descriptive* and *regional,* with the approach to the topics from the child's point of view.

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Nature Study Reader for Second Year Pupils. By Phyllis S. Darling. (Oxford University Press, Madras). 24 pages. Price annas 4.

Nature Study in a lower school, where it is done at all, is often taught in a mechanical second-hand way with sometimes a flower, fruit or leaf being taken into the class room as a concession to modern realistic methods of teaching the subject. Such work is obviously uninteresting and inadequate. The author of this small book, has brought to bear her large Indian experience and has succeeded in producing an eminently useful and suggestive book on what may really be called "general science" on a co-ordinated plan,

Quite a good part of it is taken up with what is often done in the geography lessons in the shape of weather record and the study of physical conditions, relating them to plant and animal life. It is impossible to separate the different branches of science; and the lessons in the books will show how the teacher of biology, and zoology and botany, as well as of physics and chemistry is treading close on the heels of the teacher of geography.

It is hoped that vernacular editions will soon be brought out, of such an eminently useful publication, written from a practical point of view with an insistence from the outset on observation and recording as the true method of science.

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Nature Study Readers: *Teachers' Scheme Book* (for first and second year pupils). By Phyllis S. Darling. (Oxford University Press). Pages 55. Price annas 8.

Where the foundation has to be well and truly laid for the proper study of science later on and for giving the right scientific training and outlook, the teacher of the lower school on whom this heavy responsibility lies requires detailed and suggestive guidance. Hence, with great forethought the author of the Nature Study Reader (reviewed above) has brought out this companion volume for the teacher. It covers not only the second year's work for which there is the pupils' book, but also the first year's purely observational work coupled with recording in simple outline drawing. The value of this teachers' book will enable him to use the second year pupils' book aright as also to give the first year children a preliminary outlook and training on proper lines. A vernacular edition of this book also is urgently required for general use by the lower school teacher.

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Modern Geography of the World for High School: (In 3 parts). By B. V. Narasinga Rao and N. Subba Rao. (P. N. Chidambara Mudaliar Bros., Madras). Part I-170 pages, Part II-220 pages, and Part III-164 pages. Price 12 annas each part.

This text-book of geography for high schools, prepared in accordance with the syllabus for the S.S.L.C. Course of the Madras Educational Department by two experienced teachers of

geography. The subject matter has been presented in a clear and lucid manner; and the essential facts have been presented in casual correlation. The book has been illustrated with several maps, charts, diagrams and illustrations, and includes statistical tables as well as typical questions at the end of each part.

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A Regional Geography of the World for High Schools (Revised edition). By N. Subrahmanyam. (Indian Publishing House, Ltd., Madras). Pages 455. Price Re. 1 As. 12.

The first edition of this book was reviewed in Vol. VI, No. 2 of this journal, where we stated as follows:—"The author has treated the subject in a simple, lucid and interesting manner, adopting to a large extent the descriptive style and incorporating sound doctrines of modern pedagogy in the presentation. This method has necessarily tended to swell the size of the volume, which is illustrated with a large number of suitable maps and diagrams. The type and get-up are specially attractive."

In this second edition the book has been suitably abridged by the omission of details, which are unnecessary for high school pupils. But all the essential facts and features of the earlier edition have been kept up.

Books and Journals Received

The Making of Geography: By R. E. Dickinson and O. J. R. Howarth (Oxford University Press).

Principles and Practice of Geography Teaching: By H. C. Barnard. (University Tutorial Press, Ltd., London).

The Continent of Asia: By Lionel W. Lyde (Macmillan & Co., London).

Longmans Senior Atlas for India: Edited by George Philip (Longmans, Green & Co., Ltd.).

Nature Study Reader for Second Year Pupils: By Phyllis S. Darling (Oxford University Press).

Nature Study Readers—Teachers' Scheme Book for First and Second Year Pupils: By Phyllis S. Darling (Oxford University Press).

Modern Geography of the World: *For High Schools* (Three parts): By B. V. Narasinga Rao and N. Subba Rao (P. N. Chidambara Mudaliar Brs.).

The Atlas Geography of the Tanjore District (Tamil): By G. V. Rama Ayyar, (G. V. K. Swami & Co., Kumbakonam).

Geography of the Bhimavaram Taluk for Standard III (Telugu): By S. Peri Sastry, (Venkata Ram & Co., Ellore.).

Progressive Exercises in Practical Geography—Africa and Australasia: By B. Thurston.

Map of the Madras Presidency (Tamil): (Christian Literary Society).

Geography of the Madras Presidency (Malayalam: By N. Subrahmanyam. (Longmans, Green & Co.).

Oxford School Atlas (Tamil): (Oxford University Press).

Oxford School Atlas (Telugu): (Oxford University Press).

The Indian Review—August, September, October, November and December 1933 and January 1934.

The Educational Review—September, October, November and December 1933 and January 1934.

The Indian Journal of Economics—July and October 1933.

Kalaimagal—September, October, November and December 1933 and January 1934.

South Indian Teacher—September, October, November and December 1933 and January 1934.

Quarterly Journal of the Mythical Society—July and October 1933, and January 1934.

Geography—September and December 1933.

The Indian Educator—July 1933 to January 1934.

Wealth and Welfare—August 1933 to January 1934.

Journal of Indian History—August and December 1933.

The Scotish Geographical Magazine—September and November 1933 and January 1934.

The Geographical Journal—August, September, October, November and December 1933 and January 1934.

The Geographical Review—October 1933 and January 1934.

Journal of Andhra Historical Research Society, Vol. VIII. Part I, 1933.

Royal Geographical Society of Australasia. Proceedings. 1931-32.

Our Home Magazine—December 1933.

Karnatic Historical Review—July 1933.

The Livro Da Seita Dos Indios Orientos.

Report of the Department of Industries, Madras, for the year 1932-33.

Report on the Operations of the Department of Agriculture, (Madras Presidency) 1932-33.

TEXT-BOOKS FOR STUDY UNDER GROUP A OF THE S. S. L. C, COURSE

(The books in this list have been approved by the Madras T. B. C.)

	Rs.	A.
HISTORY OF ENGLAND: By L. G. Brandon, M.A. (Cantab), with a foreword by B. Clutterbuck, M.A., of the Wesley College, Royapettah. English Edition ..	2	0
Telugu Edition: Translated by P. Lakshmikantham Pantulu, M.A., Reader, Andhra University ..	2	4
Malayalam Edition: Translated by V. K. Achyuta Menon ..	2	0
N. B.—This is the only book which satisfies the new A group Syllabus and which has been approved by the Text-Book Committee and recommended by the S. S. L. C. Board for prescription in all schools. The Gazette notification will appear shortly.		
A JUNIOR HISTORY OF INDIA (English): By V. Rangacharya, M.A.	2	0
A SHORT HISTORY OF INDIA (English): By E. G. Sutton, M.A., (Oxon) ..	1	4
INDIA CHARITRAM (Tamil): By M. K. Sundaravaradachariar, B.A., L.T. ..	1	10
HINDU DESA CHARITRA (Telugu): By Mallampalli Somasekhara Sarma. Part I—Hindu Period ..	1	0
A GEOGRAPHY OF THE WORLD FOR HIGH SCHOOLS (English Edition): By N. Subrahmanyam, M.A., L.T., F.R.G.S. Part I—The Southern Continents and North America ..	1	8
Part II—Eurasia and India ..	1	8
N. B.—This book is available in separate sections also as follows:—		
Part I, Section 1.—Australia ..	0	5
„ „ 2. Africa ..	0	6
„ „ 3. South America ..	0	6
„ „ 4. North America ..	0	8
Part II Section 1. General Geography of Eurasia ..	0	5
„ „ 2. Regions of Europe ..	0	6
„ „ 3. Regions of Asia ..	0	5
„ „ 4. India ..	0	7
Telugu Edition: Translated by K. Satyanarayana. Part I, Sections 1 and 2. Australia and Africa ..	0	12
Part I, Sections 3 & 4. South and North America ..	0	14
Part II, Sections 1 & 2. General Geography of Eurasia and Regions of Europe ..	0	12
Part II, Sections 3 & 4. Regions of Asia and India ..	0	14
Malayalam Edition: Translated by P. Rama Pisharodi. Part I, Sections 1 & 2. Australia and Africa ..	0	10
Part I, Sections 3 & 4. South and North America ..	0	14
Part II, Sections 1 & 2. General Geography of Eurasia and Regions of Europe ..	0	14
Part II, Sections 3 & 4. Regions of Asia and India ..	0	14
A REGIONAL GEOGRAPHY OF THE WORLD (English): By N. Subrahmanyam, M.A., L.T., F.R.G.S. ..	1	12
N. B.—This is an abridgement of the above book prepared so as to be more suitable.		

THE INDIAN PUBLISHING HOUSE, LTD.,

5, Sunkurama Chetty Street, G. T., MADRAS.

THE SEVENTH ANNUAL REPORT OF THE MADRAS GEOGRAPHICAL ASSOCIATION, 1932-33.

THE WORKING COUNCIL FOR 1932-33.

PRESIDENT.

Mr. Rao Saheb T. S. Subrahmania Ayyar, M.A., L.T.,

VICE-PRESIDENTS.

Mr. S. Lakshmana Ayyar, B.A., L.T.,
Mr. K. Rangaswami Ayyangar, B.A., L.T.,
Mr. M. S. Sabhesan, M.A.

SECRETARY.

Mr. N. Subrahmanyam, M.A., L.T., F.R.G.S.

TREASURER.

Mr. C. M. Gopal, B.A., L.T.

OTHER MEMBERS.

Mr. George Kuriyan, B.A., B.L. B.Sc.
Mr. B. V. Narasinga Rao, B.A., L.T.,
Mr. R. Dann.
Mr. Syed Ameeruddin Saheb, B.A., L.T. (Mofussil Member).

THE SEVENTH ANNUAL REPORT OF THE MADRAS GEOGRAPHICAL ASSOCIATION, 1932-33.

The Working Council of the Madras Geographical Association has the honour to present the following Report for the year 1932-33:—

The strength of the Association at the commencement of the year was 367. During the year 8 members resigned, and 83 were removed from the list for non-payment of arrears of subscription. 67 new members were admitted in the same period. The strength on 31-3-1933 therefore stands at 343, including 5 life members.

The Journal had 204 subscribers during the year as against 190 in the preceding year. Of these 69 are official subscribers as against 73 in the previous year and 135 are member subscribers as against 117 in the previous year. It is hoped that the present non-journal members will gradually go in for the Journal until there is only one class of members—all getting the Journal. It will then be possible to further increase the size and improve the quality of it as well as increase the number of issues during the year.

Financial Position.—The Financial Position can be seen from Appendix A which shows that the total subscriptions for the year amounted to Rs. 1851-7-9 as against Rs. 1,970 for the previous year. The Association Fund stood at Rs. 1,464-0-5 at the beginning of the year of which Rs. 300 has been credited to Capital Fund and the balance at the end of the year is reduced by Rs. 199-6-9, being the deficit incurred during the year as shown by the Income and Expenditure account. This is due to the slight fall in the total subscriptions by about Rs. 80 and the increase in the expenses for printing and publishing the Journal as well as rent for the office of the Association which is also used as a Reading Room and Library by the members.

The increase in the size and the improvement in the quality of the Journal has necessitated the additional expenditure of about Rs. 400. This amount along with the rent of Rs. 135 and the slight

decline in the subscriptions to the extent of Rs. 80 account for the small deficit. If all this expenditure had not been incurred there would have been a similar surplus as in the case of last year.

The total of the Capital and Association Funds at the end of the year stands at Rs. 1,264-9-8.

The main object of any institution like this Association being the propagation and diffusion of knowledge of the particular kind which it stands for, it is hoped that the members will take more interest in its progress by prompt payment of their subscriptions, by enlistment of fresh members and by showing greater activity in all the growing and varied work of the Association.

The Working Council met 4 times during the year. A list of the ordinary meetings of the Association is given in Appendix B.

The Third Geographical Conference was held at Madura on the 11th May 1932 and the following three days under the Presidency of Dr. A. L. Narayana, M.A., D.Sc., when 18 original papers on various aspects of the Geography of Madura and Ramnad Districts were read and discussed. These papers together with the Presidential Address have been published in Vol. VII. No. 3 (October 1932) of the Journal.

The Fourth Geographical Conference will be held at Trichinopoly in May next, as usual with the S. I. T. U. Conference, when the District of Trichinopoly will be studied in the same way as Coimbatore, Malabar, Madura and Ramnad were studied, in previous years. It is intended to arrange at the time a major excursion to Pachai Malai Hills and a few minor excursions to places of interest in the neighbourhood of Trichinopoly.

During the year under report the Vizagapatam Branch of the Association continued to show a good record of work (Vide Appendix D), while some of the Local Branches such as those at Villupuram, Chittoor and Erode practically ceased to exist. It is hoped that the other Branches will show a better activity in the coming year.

The Fourth Summer School of Geography was held in April 1932 at the Teachers' College, Saidapet and a Refresher Course

was held at Madura for the benefit of Middle School Teachers prior to the Geographical Conference.

Another Refresher Course in Geography has been arranged to be held this year at Trichinopoly for a fortnight from 1st May 1933 in two sections, one for High School teachers and the other for Middle School Teachers.

The first Diploma Course in Geography was conducted by the University of Madras and the first batch of specialists qualified in the subject are now available for handling the subject in schools and Colleges.

The Second Examination in Geography after its inclusion in the remodelled S. S. L. C. scheme was held in March 1933. It is pleasing to note that the question paper this year was of a better type than usual with a larger number of short questions requiring simple and straightforward answers. It is hoped that this type of questioning will become more common in future.

Meantime, however, before there has been any time for watching the results of the recently reorganised S. S. L. C. Course, a very revolutionary step appears to have been taken by the S. S. L. C. Board in squeezing out the substantial subjects of secondary education such as History, Geography and Elementary Science from between a glorified elementary education consisting of the three R's and an incipient and immature University System in the shape of two C's (C. group subjects) with its too early specialisation in the High School classes. It is hoped that the new scheme will not be rushed through before the considered opinion of Practical Educationists is obtained.

In conclusion, the Working Council is pleased to find that Geography is gaining ground in the University though in the High School dark days seem to be in store for it, as its inclusion in the course as a mere C group subject will not give that general training and outlook which every citizen ought to possess.

(By Order)

Gopalapuram, Cathedral Post.
Madras, 6th April 1933.

N. SUBRAHMANYAM,
Secretary.

THE MADRAS GEOGRAPHICAL ASSOCIATION, MADRAS.

Income and Expenditure Account for the Year Ending 31st March 1933.

Expenditure.		Rs.	a.	p.	Income.		Rs.	a.	p.
To Journal Expenses	..	1,344	3	0	By Subscriptions received and outstanding:—				
„ Expenses of Branches	..	37	12	0	Life Membership	..	94	0	0
„ Madura Refresher Course	..	176	12	0	Ordinary Membership	..	688	0	0
„ Sationery	..	21	0	0	The Journal	..	1,069	7	9
„ Clerical Services	..	50	0	0	„ Sale of copies of Journal	..	37	0	0
„ Postage	..	260	3	3	„ Madura Refresher Course Fees	..	100	0	0
„ Conveyance & Cooly	..	12	9	0	„ Postal Charges recovered	..	18	0	0
„ Audit Expenses	..	16	0	0	„ Advertisements	..	40	0	0
„ Meeting Expenses, Telephone & Sundries	..	4	13	0	„ Bank Interest	..	39	5	9
„ Rent	..	135	0	0					
„ Balance c|d.	..	27	9	3					
Total	..	2,085	13	6	Total	..	2,085	13	6
To Irrecoverable subscriptions written off:—					By Balance c|d.	..	27	9	3
„ Ordinary Membership	..	168	0	0	„ Deficit (to Balance Sheet).	..	199	6	9
„ The Journal	..	59	0	0					
Total	..	227	0	0	Total	..	227	0	0

N. SUBRAHMANYAM, Secretary. C. M. GOPAL, Treasurer. G. L. NARASIMHAM, Auditor.

THE MADRAS GEOGRAPHICAL ASSOCIATION, MADRAS.

Statement of Receipts and Disbursements for the Year Ending 31st Mar. 33.

Receipts.		Rs.	a.	p.	Disbursements.		Rs.	a.	p.
Opening Balances:					Journal Expenses	..	1,294	3	0
Cash on hand	..	56	0	0	Expenses of Branches	..	37	12	0
Indian Bank, S. B. A|c	..	909	0	10	Madura Refresher Course	..	176	12	0
Imprest A|c	..	0	12	1	Books, Maps and Equipment	..	99	9	6
Bank Interest	..	39	5	9	Stationery	..	21	0	0
Suscription:					Clerical Services	..	50	0	0
Life Membership	..	159	0	0	Postage	..	260	3	3
Ordinary Membership	..	499	0	0	Conveyance & Cooly	..	12	9	0
The Journal	..	691	7	9	Audit expenses	..	16	0	0
Sale of copies of Journal	..	37	0	0	Furniture	..	99	13	0
Madura Refresher Course Fee	..	100	0	0	Meeting expenses, Telephone and Sundries	..	4	13	0
Postal Charges recovered	..	18	0	0	Rent	..	120	0	0
Advertisements	..	40	0	0	Summer School,	..	25	0	0
					Closing Balances:				
					Cash on hand	..	2	0	0
					Indian Bank Ltd., S. B. A|c.	..	321	14	4
					Imprest A|c.	..	8	1	4
Total	..	2,549	10	5	Total	..	2,549	10	5

N. SUBRAHMANYAM, Secretary. C. M. GOPAL, Treasurer. G. L. NARASIMHAM, Auditor.

THE MADRAS GEOGRAPHICAL ASSOCIATION, MADRAS.

BALANCE SHEET AS ON 31ST MARCH 1933.

Liabilities.		Rs. a. p.
Advance Subscriptions ..		40 0 0
Liabilities for Rent and Journal expenses ..		65 0 0
Summer School :		
Balance as per last—		
Balance Sheet	26 12 6	
Less adjusted	25 0 0 ..	1 12 6
Capital Fund ..		300 0 0
Association Fund:		
Balance as per last		
Balance Sheet	1,464 0 5	
Less to Capital Fund	300 0 0	
„ Deficit as per I. & E. account	199 6 9	
	499 6 9 ..	964 9 8
Total ..		1,371 6 2

Assets.		Rs. a. p.
Furniture (at cost) ..		120 13 0
Books, Maps &. Equipment ..		99 9 6
Subscriptions Due:		
Life Membership ..		100 0 0
Ordinary Membership:—		
for 1931-32.	Rs. 14	
1932-33	„ 248 ..	262 0 0
The Journal:—		
for 1930-31	Rs. 14	
1931-32	„ 28	
1932-33.	„ 415 ..	457 0 0
Cash & other Balances:		
Cash on hand ..		2 0 0
Balance on current a|c with Indian Bank, S. B. A|c ..		321 14 4
Balance of Imprest A|c. ..		8 1 4
Total ..		1,371 6 2

N. SUBRAHMANYAM,
Secretary.

C. M. GOPAL,
Treasurer.

G. L. NARASIMHAM,
President.

AUDIT REPORT.

Verified the above Balance Sheet with the accounts of the Madras Geographical Association, Madras. In my opinion, the statement is properly drawn up and shows a true and correct view of the state of affairs of the Association according to the books maintained and the information and explanations furnished to me.

Madras,
3*rd April* 1933.

G. L. NARASIMHAM, R.A.,
Registered Accountant & Auditor.

Appendix B.

LIST OF MEETINGS HELD IN 1932-33.

Date.	*Subject.*	*Lecturer,*	*Chairman.*
23-4-32.	Geographical Evolution of India.	Mr. T. N. Muthusami, M. A.	Mr. T. R. Venkatramasastri, B.A., B.L.
30-7-32.	Mahenjo-Daro and the Indus Valley Civilization.	Mr. K. N. Dikshit, M.A.	Prof. K. A. Nilakantasastri, M.A.
5-11-32.	Geography of the Sugar Industry in South India.	Mr. K. C. Ramakrishnan, M.A.	Mr. V. Ramakrishnan, I.C.S.
28-1-32.	History of South Madras: Adyar and Teynampet.	Prof. V. Rangachary, M.A.	Dr. H. Gravely, D.Sc.
1-2-32.	My Tramps in the Himalayas.	Miss G. E. Benham.	Mr. N. Subramanyam, M.A., L.T.
4-3-33.	History of South Madras: Mylapore and San Thome.	Prof. V. Rangachary, M. A.	Mr. T. R. Venkatramasastri, B.A., B.L.

Appendix C.

PAPERS READ AT THE THIRD GEOGRAPHICAL CONFERENCE AT MADURA, MAY 1932

1. *Presidential Address—Meteorology of Madura*: By Dr. A. L. Narayana, M.A., D.Sc.
2. *The Physical Geography of the Madura District*: By Mr. T. N. Muthusami, M.A., L.T.
3. *The Sub-Regions of the Madura District*: By Mr. G Narayanasami, M.A., L.T.
4. *The Forests of the Madura District*: By Mr. W. C. Hart.
5. *The Hill Produce of Madura*: By Mr. K. C. Ramakrishnan, M.A,

6. *The Fauna of Madura and Ramnad Districts*: By Mr. C. P. Gnanamuthu, M.A., F.Z.S.

7. *A note on the Fishing Industry of the Ramnad District*: By Dr. D. W. Devanesan, M.A., Ph.D., D.I.C.

8. *Cotton Growing in Madura-Ramnad*: By Mr. S. V. Duraiswami Ayyar, B.A., B.Sc. (Ag.).

9. *A Brief Survey of Economic Geography*: By Prof. A. J. Saunders, M.A., Ph.D.

10. *The Economic Conditions and Possibilities of Pandya Nad*: By Mr. C. A. Krishnamurthi Rao, M.A., F.R. Econ. S.

11. *Fairs and Trade Centres of Madura and Ramnad*: By Mr. V. Krishnan, M.A. (Hons.), Dip. Econ.

12. *A Note on the Communication Lines of Madura and Ramnad Districts*: By Mr. N. Subrahmanyam, M.A., L.T., F.R.G.S.

13. *Urban Geography of Madura*: By Mr. R. Dann.

14. *Place Names in Pandinad*: By Mr. S. Somasundara Bharathi, B.A., B.L.

15. *Human Geography of the Ramnad District*: By Mr. J. S. Ponniah, M.A.

16. *The Kumbam Valley*: By Mr. P. S. Ramaswami Ayyangar, B.A., L.T.

17. *Limits of the Pandyan Kingdom*: By Mr. Rao Sahib C. M. Ramachandra Chettiar, B.A., B.L.

18. *Why Tamil Became so well Developed at Madura*: By Mr. Rao Sahib C. M. Ramachandra Chettiar, B.A., B.L.

19. *Agricultural Geography of Madura*: By Mr. A. S. Rajamanikkam, M.A.

APPENDIX D.

LIST OF MEETINGS OF THE VIZAGAPATAM BRANCH.

	SUBJECT.	LECTURER.	PRESIDENT.
23— 7—32	Inaugural Address: Geography of the Universe.	Dr. I. Ramakrishna Rao.	Prof. M. Venkatrangayya.
24— 9—32	Geographic Controls.	Mr. T. Rama Rao.	Mr. V. Ramabrahmam.
4—11—32	The Geographical Interpretation of History.	Mr. G. Venkat Rao.	
3—12—32	Some Aspects of the Urban Geography of S. India.	Mr. N. Subrahmanyam.	Mr. M. Kamayya.
4—12—32	Economic Resources of Andhra Desa.	Mr. V. V. Sarma.	
15—12—32	Vizagapatam Harbour.	Mr. W. C. Ash.	Sir J. C. Coyagee.
2— 3—33	Modern Tests and Examinations in Geography.	Mr. N. Subrahmanyam.	Mr. V. Ramabrahmam.

APPENDIX E.

LIST OF MEMBERS OF THE ASSOCIATION.

426 Mr. T. Abdur Rahman, M.A.,
Car Street,
KADIRI.

57 Mr. N. Achyutharaman, B.A., L.T.,
Assistant, Mahajana High School,
ERODE.

173 Mr. R. Agoram,
Assistant, Board High School,
NANNILAM.

56 Mr. N. K. Adyantaya, B.A. (Hons.), B.Sc.,
University Lecturer in Statistics,
3/27, Irusappagramani Street,
Triplicane, MADRAS.

158 Miss T. Ammuni Ammal,
Teacher, Lady Sankar Nair Girls' High School,
OTTAPALAM.

93 Mr. V. Annaiyya, B.A.,
Assistant, S. M. D. H. S. School,
TIRUPATI.

36 Mr. M. Ananta Bhat, B.A., L.T.,
Teacher, St. Aloysius College,
MANGALORE.

82 Mr. T. S. Ananthanarayanan, B.A., L.T.,
Assistant, Board High School,
LALGUDI.

19 Mr. Syed Amiruddeen, B.A., L.T.,
Headmaster, Municipal High School,
CUDDAPAH.

214 Mr. M. S. Ananthakrishna Ayyar, B.A.,
Teacher, High School,
TRICHUR.

234 Mr. S. Ananthanarayana Ayyar,
10, Pandadimal, Andar Street,
Teppakulam, TRICHY.

181 Mr. T. Appalanarasayya, M.A.,
Junior Deputy Inspector of Schools,
Coconada Range, COCONADA.

188 Mr. P. Appa Rao,
Teacher, Board High School,
KOLLUR (Guntur Dt.).
14 Mr. A. Appadorai, M.A., L.T.,
Lecturer, Loyola College,
Nungambakkam, MADRAS.
389 Mr. D. Appa Rao, B.A., L.T.,
5th Assistant, Municipal High School,
NARASARAOPET.
251 Mr. A. N. Ardhanary, B.A., L.T.,
c/o Mr. S. Narayana Ayyar,
BHAWANI.
265 Mr. R. Balaji Rao,
Teacher, High School,
DEVAKOTTAH.
332 Mr. S. Balakrishna Ayyar, B.A., L.T.,
Lecturer, Teacher's College,
SAIDAPET.
424 Mr. K. H. Balasubramaniam, B.A.,
c/o Mr. V. V. Parameswara Ayyar,
Headmaster and Manager,
Native High School, PALGHAT.
447 Mr. S. Balasubramaniam, B.A.,
No. 2, New Street,
MANNARGUDI.
362 Mr. A. Balasundaram, B.A.,
Teacher, Board High School,
CHENGAM.
306 Mr. V. S. Balasundaram, B.A.,
Teacher, R. C. Training School,
TINDIVANAM.
230 Mr. Balraj M. Victor, B.A., L.T.,
Headmaster, Wesleyan Mission Secondary School,
ST. THOMAS MOUNT.
289 Mr. E. E. Berry, M.A.,
Headmaster, Stanes European High School,
COIMBATORE.
17 Mr. C. Bhimasena Rao, B.A., L.T.,
Teacher, P. R. College School,
COCONADA.
62 Miss E. D. Birdseye, B.Sc.,
Wesleyan Mission Girls' High School,
Royapettah, MADRAS.

137 Mr. K. Brahmaji Rao, B.A., B.Ed.,
School Assistant, Govt. Training School,
VIZAGAPATAM.

126 Mr. J. Brito, B.A., L.T.,
Assistant, St. Aloysius College School,
MANGALORE.

373 Rev. F. C. Browne, M.A., L.T.,
Principal, St. Joseph's Indian Section,
BANGALORE.

258 Mrs. G. A. Chambers,
CHROMEPET.

138 Mr. H. Champion, M.A.,
Principal, Teachers' College,
SAIDAPET.

344 Mr. K. R. Chandrasekhar, B.A.,
Teacher, S. P. G. School,
SECUNDERABAD (Dn.).

116 Mr. A. S. Chidambaram Pillai, B.A., L.T.,
c/o C. S. Ganapathi Rao Pillai, Superintendent,
Chatram Dept., New Town, TANJORE.

399 Mrs. C. Chinnammu Mannadisiar, B.A.,
Headmistress, Board Moyan Girls' High School,
PALGHAT.

199 Mr. Rao Saheb S. Dandapani Ayyar, B.A.,
Gopalapuram, MADRAS.

133. Mr. C. D. S. Chetti, M.A.,
Registrar, Andhra University,
Gokhale Road, VIZAGAPATAM.

124 Mr. R. Dann,
Director of Town Planning, Chepauk, MADRAS.

241 Mr. V. Desikachari, M.A., L.T.,
Assistant, Municipal High School, GUDIYATAM.

431 Mr. D. Desikan, B.A.,
Assistant, Hindu High School, WATRAP.

430 Mr. M. Desinga Rao, B.A.,
18, Erusappagramani St., Krishnampet,
Triplicane, MADRAS.

115 Mr. N. Divakara Rao, M.A., L.T.,
899, Mount Road, COONOOR R. S.

337 Mr. S. K. Devasikamani, B.A., L.T.,
Headmaster, Bishop Heber High School,
TEPPAKULAM.

10 Mr. W. Doraiswami Iyengar,
Manager, Messrs. Longmans Green & Co.,
Mount Road, MADRAS.

341 Mr. P. V. Doraiswami Ayyar, B.A., L.T.,
Teacher, Sircar High School,
Thiruvilwamala, (via) OTTAPALAM.

410 Mr. P. Doraikannu, B.A.,
50, Guruvappa Chetty Street,
Chintadripet, MADRAS.

246 Mr. S. Duraiswami Ayyar, B.A., B.L.,
Advocate, "Palm Grove,"
Mylapore, MADRAS.

205 Srimati V. K. Droupadi Ammal, B.A., L.T.,
Headmistress, V. G. School, TRICHUR.

197 Mr. D. Ebenezer,
Assistant, Training School, PASUMALAI.

213 Miss H. A. Edington,
St. Michael's School,
CIRENCESTER (Gloucester), England.

187 Mr. M. S. Ekambara Rao, B.A., L.T.,
Headmaster, Ganapati High School, MANGALORE.

356 Mr. B. V. Gangadharan, B.A.,
Teacher, Rao Saheb H. J. Belligounder's High School,
ARAVANKADU.

288 Mr. V. Garudadri,
Commercial Instructor, High School,
DEVAKKOTTAH.

1 Miss J. M. Gerrard, M.A.,
Principal, Lady Willingdon Training College,
Triplicane, MADRAS.

285 Mr. C. M. Gopal, B.A., L.T.,
Assistant, Model High School,
Teachers' College, SAIDAPET.

231 Mr. N. Gopalan, B.A.,
Teacher, National High School,
21, Othai Street, MANNARGUDY.

74 Mr. N. Gopalakrishna Rao, B.A., L.T.,
Assistant, Board High School, PUTTUR (S. Kanara).

151 Mr. R. N. Gopalaswami Naidu,
Lithographer, 16, Ramasami Pillai Street,
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